U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-266 719

Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities. Volume 3. Summaries of Technical Data for Combined Sewer Overflows and Stormwater Discharge. 1976 Needs Survey

Environmental Protection Agency, Washington, D.C.

10 Feb 77

United States
Environmental Protection
Agency

Office of
Water Programs Operations
Washington, D.C. 20460

February 10, 1977
430/9-76-012

PB 266 719

Cost Estimates for Construction of Publicly-owned Wastewater Treatment Facilities

Summaries of Technical Data for Combined Sewer Overflows and Stormwater Discharge

1976 NEEDS SURVEY

MCD-48C

BIBLIOGRAPHIC DATA SHEET

1. Report No. EPA 430/9-76-012 MCD-48C

2.

3. Recipient's Accession No.

4. Title and Subtitle
Cost Estimates for Construction of Publicly-owned Wastewater Treatment Facilities -- Summaries of Technical Data for Combined Sewer Overflows and Stormwater Discharge

5. Report Date

6.

7. Author(s)
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8. Performing Organization Rept. No.

9. Performing Organization Name and Address
US Environmental Protection Agency (OWPO - WH-547)
401 M. St., SW
Washington, DC

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address
Same as Box 9

13. Type of Report & Period Covered
Technical Report 1976

14.

15. Supplementary Notes

16. Abstracts

This volume contains the technical rationale and supporting technical data used for estimation of need in categories V & VI

17. Key Words and Document Analysis. 17a. Descriptors

Cost estimates for Wastewater Facilities

17b. Identifiers/Open-Ended Terms

Reproduced from best available copy.

17c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report)
UNCLASSIFIED

20. Security Class (This Page)
UNCLASSIFIED

21. No. of Pages
401

22. Price
PC A18 / MF A01

Document Number	Title and Content
430/9--76--010 (MCD-48A)	"Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities -- 1976 Needs Survey" This volume contains cost estimates for needed publicly-owned wastewater treatment facilities for eight Needs Categories in each of the States and Territories.
430/9--76--011 (MCD-48B)	"Summary of Technical Data" (Categories I-IV) This volume consists of summaries of technical data collected in the course of the field work of the Needs Survey in Categories I through IV.
430/9--76--012 (MCD-48C)	"Summary of Technical Data For Combined Sewer Overflow and Stormwater Discharge" This volume contains the technical rationale and supporting technical data used for the estimation of need in Categories V and VI.

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Cost Estimates for Construction of Publicly-owned Wastewater Treatment Facilities

1976 NEEDS SURVEY
SUMMARIES OF TECHNICAL DATA FOR COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGES

Contract No. 68-01-1984
EPA Report No. 430/9-76-012
MCD Report No. 48C

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ABSTRACT

The 1976 Needs Survey for Category V (correction of combined sewer overflows) and Category VI (treatment and/or control of stormwater discharges) was developed using a well defined, consistent nationwide methodology. The Needs Survey developed current and 1990 capital and annual operation and maintenance cost estimates to attain three water quality criteria: Aesthetics, Fish & Wildlife and Recreation.

A computer model, called the Needs Estimation Model for Urban Runoff, was developed from intensive work with the literature of a detailed analysis of ten specific urbanized areas. The model calculates the combined sewer and stormwater control needs for each urbanized area. These estimates are then summed on a state and territory basis to provide the national estimated needs for Categories V & VI.

The estimated needs are significantly lower than those developed by earlier Needs Surveys. The consideration of receiving water assimilative capacity, a relatively small design storm, a well defined area for stormwater control, and a nationwide consistent methodology are the primary reasons for the reduction in estimated needs.

The methodology provides a reasonable and well defined estimate of the eligible costs for water quality control required by combined sewer overflows and stormwater runoff. They also provide a consistent basis for comparison of relative needs among the states. The cost estimates for Category V are of much better quality than the cost estimates for Category VI as more is known about the variables affecting Category V costs than is known about the variables affecting Category VI costs.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ADR	Number of Storms per year
ARF	Average Yearly Rainfall
ASCO	Average Drainage Area per Combined Sewer Overflow
BOD_5, STATE1	Five-Day BOD for Portion of Urbanized Area in STATE1
BOD_5, STATE2	Five-Day BOD for portion of Urbanized Area in STATE2
CM	Curb Miles in Storm Sewered Area
$\mathrm{COST}_{\mathrm{CSO,CAP}}$	Category V Capital Costs
$\mathrm{COST}_{\mathrm{CSO,O\&M}}$	Category V O&M Costs
$\mathrm{COST}_{\mathrm{SSA,CAP,PRESENT}}$	Category VI Present Capital Costs
$\mathrm{COST}_{\mathrm{SSA,CAP,\ 1990}}$	Category VI 1990 Capital Costs
$\mathrm{COST}_{\mathrm{SSA,O\&M}}$	Category VI O&M Costs
CSA	Combined Sewer Area
CSAP	Combined Sewer Area Population
CSI	Combined Sewer Area Imperviousness
CTR	Consolidated Treatment Rate for Combined Sewer Overflows
DS	Design Storm
DVCS	Design Volume of Combined Sewer Treatment
DVGA	Design Volume from the Urbanized Area Growth Area
DVSS	Design Volume of Storm Sewer Treatment
DWB	BOD Dry Weather Loading in Urbanized Area
DWF	Dry Weather Flow in Urbanized Area
IC	Interceptor Cost
IL	Interceptor Length
IMAR	Impervious Land Area in Storm Sewered Area
K2	Reaeration Coefficient
LAND	Land Area Containing Storm Sewers
$\mathrm{LEVEL}_{\mathrm{CSO}}$	Level of Treatment For Combined Sewered Area
$\mathrm{LEVEL}_{\mathrm{SSA}}$	Level of Treatment For Storm Sewered Area
MNS	Mean Number of Storms Per Year
MRF	Mean Annual Rainfall
NSSTP	Number of Storm Sewer Treatment Plants
NSP	Number of Combined Sewer Storage Facilities
NTP	Number of Combined Sewer Treatment Plants
PDCS	Population Density of the Combined Sewer Area
PDSS	Population Density of the Storm Sewer Area
$\mathrm{POL}_{\mathrm{BOD,CSO}}$	BOD Loading in Combined Sewer Area
$\mathrm{POL}_{\mathrm{BOD,SSA}}$	BOD Loading in Storm Sewer Area

LIST OF ABBREVIATIONS (Cont'd)

Abbreviation	Description
$POL_{SS,CSO}$	Suspended Solids Loading in Combined Sewer Area
$POL_{SS,SSA}$	Suspended Solids Loading in Storm Sewer Area
POP	Population in Storm Sewer Area
POP_{GA}	Population in the Urbanized Area Growth Area
POP_{90}	1990 Urbanized Area Population
PPRS	Percent of Pollutants Removed by Sweeping
PR1	Percent of BOD Removed by Treatment Level
PR2	Percent of Suspended Solids Removed by Treatment Level
PRDS	Percent of Runoff Due to Streets
PSF_{STATE1}	Percent of Streamflow Assigned to STATE1
Q_{DS}	Flow Downstream from Urbanized Area
RF	Removal Factor
ROC	Runoff Coefficient in Combined Sewered Area
ROCI	Percent of Runoff From Storm Sewered Impervious Area
ROCS	Runoff Coefficient in Storm Sewered Area
RR	Percent Pollutant Removal Required
SAR	Percent Impervious Area Due to Streets
SM	Street Miles in Storm Sewered Area
$SMSA_{70}$	1970 SMSA Populations
$SMSA_{90}$	1990 SMSA Populations
SPTP	Storage per Storm Sewer Treatment Plant
SSI	Percent Imperviousness in Storm Sewered Area
$STATE_{EPA}$	EPA 1990 State Ceiling Populations
$STATE_{OBERS}$	OBERS 1990 State Populations
STCS	Storage per Combined Sewer Treatment Plant
STR	Receiving Stream Flow
STR_{STATE1}	Receiving Stream Flow Attributed to STATE1
TRCS	Discharge Rate of Combined Sewer Storage Facility
TRSS	Treatment Rate of Storm Sewer Treatment Plant
UA	Land Area of the Urbanized Area

LIST OF ABBREVIATIONS (Cont'd)

Abbreviation	Description
UA_{90}	Urbanized Area 1990 Land Area
UAG	Growth in Urbanized Area Land Area
UAP	Urbanized Area Population

ACKNOWLEDGMENTS

This report was developed by Jordan, Jones and Goulding, Inc. and Black Crow and Eidsness, Inc. Billy G. Turner of JJ&G was the Project Manager and provided overall project coordination and management. Robert A. Corbitt and Robert F. Holbrook of JJ&G and Ronald L. Wycoff of BC&E served as Task Investigators and were instrumental in preparation of the overall report. Robert W. Olson of JJ&G developed the computer code for NEMUR. Gregory Tate of BC&E performed a large portion of the site study evaluations.

Especially acknowledged is the leadership and review of Philip H. Graham, Facilities Requirements Branch, Municipal Construction Division, EPA, who was the Project Officer; and Michael Cook, Chief, Facilities Requirements Branch, EPA. Both of these individuals provided invaluable guidance and review throughout the project. Numerous other individuals from the EPA Storm and Combined Sewer Technology Branch and headquarters offices provided significant cooperation and direct participation.

SUMMARY

By authority of the Federal Water Pollution Control Amendments of 1972, the Environmental Protection Agency, in cooperation with the states, is required biennially to update estimates of needs to meet the water quality control provisions of that law.

In previous years, national estimates have been made for water quality control for various categories of needs but little emphasis has been placed on needs for rainfall induced requirements of combined sewer overflow correction (Category V) and treatment and/or control of storm waters (Category VI). Estimates for Category V were developed in 1973 and 1974 and an estimate for Category VI needs was developed in 1974. It is well known that these estimates were based often on minimal data and there was little consistency in the methodologies utilized by the individual states.

For the 1976 Needs Survey, EPA chose to estimate the needs with the assistance of a contractor using a well defined, consistent nationwide methodology. This methodology has as its objective the development of present and 1990 capital as well as annual operation and maintenance cost estimates for Categories V and VI. Cost estimates were developed for attaining three levels of water quality, which are:

- Aesthetics - waters which are aesthetically compatible with adjacent areas and contain no floating or settleable materials which would interfere with designated stream uses;
- Fish & Wildlife - waters which meet all characteristics of the Aesthetics criteria and in addition provide for dissolved oxygen (average daily >5.0 mg/l, minimum >4.0 mg/l), pH (6.0 - 8.5) and solids (average monthly <80 mg/l, maximum <400 mg/l) concentrations compatable with the propagation of aquatic organisims; and
- Recreation - waters which meet all characteristics of the Aesthetics and Fish and Wildlife criteria and in addition provide for a monthly geometric mean concentration of fecal coliform organisms not to exceed 200 per 100 ml.

The cost estimates were prepared to meet these water quality levels through the use of a computer model which took into account numerous factors. Some of the input data used in the model are:

- Demographic data for 279 urbanized areas or 320 areas when subdivided by state boundaries. This data consisted of 1970 and 1990 populations and land areas;

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- Combined sewered areas;
- Cost indices developed from a 25 city index for January, 1976;
- Hydrologic data consisting of average annual rainfall; and the number of days with rain for each urbanized area;
- Average minimum receiving stream flow for a three month period;
- Reaeration coefficients based on a description of the principal receiving streams, and
- Percentage of the urbanized area draining to the receiving stream.

Using these input data, the model, Needs Estimation Model for Urban Runoff, progresses through a sequence of more than 400 mathematical steps to calculate the Categories V and VI estimated needs for each urbanized area. These estimates were then summed on a state and territory basis to provide the national estimated needs for Categories V & VI.

These needs estimate the present costs to control combined sewer overflows from the U.S. Bureau of Census defined urbanized areas and the areas outside urbanized areas that are indicated to have combined sanitary and storm sewers. It was assumed that no construction of combined sewers would occur in the future. Therefore, the Category V estimates are based on the current condition. Cost estimates for treatment of combined sewer overflows to meet the three stream criteria are shown below.

Category and Water Quality Criteria	Needs Estimate (Millions of January, 1976 Dollars)		
	Current Capital Costs	1990 Capital Costs	Annual O&M Costs
Category V - Control of Combined Sewer Overflows			
Aesthetics Water Quality Criteria	5,586	5,586	183
Fish & Wildlife Water Quality Criteria	12,088	12,088	173
Recreation Water Quality Criteria	18,262	18,262	248

The needs for stormwater treatment and/or control, shown below; are based on providing control for stormwater runoff from urbanized areas. Treatment and/or control levels were selected for each urbanized area based on the stream criteria and the assimilative capacity of the receiving water.

Category and Water Quality Criteria	Needs Estimate (Millions of January, 1976 Dollars)		
	Current Capital Costs	1990 Capital Costs	Annual O&M Costs
Category VI - Control of Stormwater Discharges			
Aesthetics Water Quality Criteria	866	20,471	1,119
Fish & Wildlife Water Quality Criteria	31,071	50,675	3,181
Recreation Water Quality Criteria	34,528	54,133	3,208

The methodology was developed to estimate state-by-state needs and as such should not be expected to predict accurately the needs for any specific area. Due to the state of the art and the fact that most of the actual cost data used in development of cost estimating equations came from combined sewer control projects, the Category V estimates are of much higher quality than those of Category VI. The Category V estimates are also better than the Category VI estimates because the effectiveness of the technologies used in Category VI to improve receiving water quality is not as well known as the effectiveness of combined sewer overflow control technologies.

PART I

BACKGROUND AND OBJECTIVES

Section 1

INTRODUCTION

To comply with the Federal Water Pollution Control Act Amendments of 1972, the Environmental Protection Agency has conducted the 1973 and 1974 Survey of Needs for Municipal Wastewater Treatment Facilities. This report is to provide a consistent and realistic basis for estimating needs in Category V, combined sewer, and Category VI, stormwater, of the 1976 Needs Survey.

1.1 NEEDS SURVEY BACKGROUND

The Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, tasked the Environmental Protection Agency, EPA to estimate the needs of publicly owned treatment facilities to meet the 1983 water quality requirements of P.L. 92-500. Section 516(b) of P.L. 92-500 requires EPA to make a detailed estimate of individual state needs as well as total national needs for the construction of all publicly owned treatment works. The national needs survey is to be completed biennially and submitted to Congress not later than February 10 of each odd numbered year.

Due to shortcomings of initial needs surveys, Congress passed P.L. 93-243 to emphasize the inclusion, among other things, of the needs for control and/or treatment of stormwaters.

1.2 SUMMARY OF PREVIOUS SURVEYS

The first comprehensive needs survey was the 1973 Survey of Needs for Municipal Wastewater Treatment Facilities, 1973 Needs Survey. With the cooperation of EPA, the states and local governments, the 1973 Needs Survey focused on the needs to achieve the 1977 requirements of P.L. 92-500. The needs were determined by five categories: I - Secondary Treatment, II - More Stringent Treatment, III - Infiltration/Inflow Correction, IVa - New Interceptor Sewers, IVb - New Collector Sewers, and V - Combined Sewer Overflow Correction. Identified needs totaled $60.123 billion. Needs for storm water control and major sewer system rehabilitation were not included in the 1973 Needs Survey.

Following review of the results of the 1973 Needs Survey, Congress established the allocation formula for fiscal year 1975, which was a result of House Public Works Committee Print No. 93-28 and implemented by P.L. 93-243. The allotments were proportioned one-half on the basis of needs reported in Categories I, II, and IVa (treatment plants or interceptors), and one-half on the basis of total needs in all five categories of the 1973 Needs Survey. The 1973 Needs Survey identified a total of $35.910 billion for the cost of needed wastewater treatment facilities (Categories I and II) and interceptor sewers (Category IVa). The allocation gave each state at least the amount of funds allocated in fiscal year 1972.

Even though EPA's final report on the 1973 Needs Survey was not submitted to Congress until November, 1973, a new survey was needed in 1974 to meet the requirement of P.L. 92-500 for an updated report by February 10, 1975.

Recognizing a need to address the cost for achieving the 1983 goals of P.L. 92-500, as well as the eligible costs for the treatment and/or control of stormwater, Congress, through passage of P.L. 93-243, required EPA to amend the 1973 survey approach to include these projects in the new needs survey.

The 1974 Needs Survey divided Category III into: IIIa - Infiltration/Inflow Correction, and IIIb - Major Sewer System Rehabilitation, and added Category VI - Treatment and/or Control of Stormwaters. The subcategories of Category IV were renumbered such that all collectors were reported in Category IVa and interceptors were reported in Category IVb. As with the 1973 Needs Survey, a limited amount of time was available for the states and local authorities to complete the 1974 Needs Survey. During mid-May 1974, regional meetings were conducted by EPA to provide the states with guidance, including instructions on preparation of Category VI needs for the treatment and/or control of stormwaters. The time restrictions for the survey required the states to submit a summary report by July 26, 1974 and a final state report by August 20, 1974. Also, EPA was required to supply Congress a preliminary report by September 3, 1974.

The results of the 1974 Needs Survey showed that needs to meet the objectives of Categories I through IV totaled $76.360 billion. The estimated needs for Categories V and VI were $31.076 billion and $235.006 billion, respectively. The reported costs for Category V in 1974 increased by some 245 percent over those in 1973. Both surveys considered needs for the projected 1990 population and reported in June, 1973 dollars.

EPA provided specific guidance to the states and municipalities for Categories I through IV. Some guidance was available for Category V and only general guidance was presented for Category VI. However, the results were to be used as a basis for allocating federal funds and varying methodologies were utilized which impacted the important factors of estimates of population connected to the sewers, projections of per capita flow and industrial flow, effluent limitations more stringent than those actually required to meet water quality standards, and design storm conditions. The cost of facilities is quite sensitive to all of these factors, which identifies the need for a uniform methodology to be applied nationwide.

Under authority of Section 315 of P.L. 92-500, the National Commission on Water Quality, NCWQ, developed an independent survey to estimate the costs of achieving the requirements of P.L. 92-500 for publicly owned treatment works. This assessment, done on a nationwide basis, involved four basic steps: 1) an identification of needed facilities, together with enough information to define the types of technologies that might be applicable; 2) a determination of available technologies most likely to be used to meet the needs identified, and for each technology, the costs; and 3) an assignment of available technologies to individual needs, followed by 4) addition of costs. A similar approach was taken in estimating quantities of residual wastes generated and requirements for manpower, energy, materials and land.

Nationwide totals for Categories V and VI from each of the previous three needs surveys are shown in Table 1.1. Each of the surveys has significant shortcomings due to the variable data base used in the assessment. The most significant of these shortcomings were the lack of a consistent nationwide methodology for the 1973 and 1974 Needs Surveys and the lack of specific receiving water assimilative capacity considerations in the NCWQ assessment. Therefore, a new methodology was developed for the 1976 Needs Survey.

1.3 1976 NEEDS SURVEY

By separate contracts, EPA is having consultants estimate needs for Categories I through IV and for Categories V and VI, respectively. In accordance with Contract Number 68-01-1984, this report is to estimate the latter needs. More specifically, EPA is to be provided updated nationwide estimates on a state-by-state basis of various control strategies for pollutant discharges from (1) combined sewer and (2) stormwater collection networks together with a clear, critically written, concise description of the methodology, data base and assumptions necessary to produce these estimates. The states were to be afforded an opportunity for review and comment prior to submittal of EPA's report to Congress.

Unlike previous surveys, the Categories V and VI estimates are developed at three different water quality levels for selected pollutants. Also, the contract divided the estimates into the following six divisions:

- Current Year Capital Needs - Category V
  Capital costs needed to fund alternatives, sized for the current metropolitan development pattern, to control selected pollutants in combined sewer overflow discharges.

- Current Year Capital Needs - Category VI
  Capital costs needed to fund alternatives, sized for the current metropolitan development pattern, to control selected pollutants in stormwater discharges.

- 1990 Needs - Category V
  Capital costs needed to fund alternatives, sized for the 1990 metropolitan development pattern, to control selected pollutants in combined sewer overflow discharges.

TABLE 1,1

COMPARISON OF PREVIOUS NEEDS SURVEYS

Category	CAPITAL COSTS (Billions of June, 1973 Dollars)		
	1973 Needs Survey	1974 Needs Survey	NCWQ Assessment
V. Correction of Combined Sewer Overflows	12,7	31.1	61.3 (4.2-68.4)[1]
VI. Treatment and/or Control of Stormwaters	---	235,0	153 (46 - 349)[1]
TOTALS	12.7	266.1	214.3 (50.2-417.4)[1]

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[1] Indicates range depending on control level.

- 1990 Needs - Category VI
  Capital costs needed to fund alternatives, sized for the 1990 metropolitan development pattern, to control selected pollutants in stormwater discharges.

- Operation and Maintenance Costs - Category V
  Annual equivalent operation maintenance and repair costs during 20-year planning period for alternatives to control selected pollutants in combined sewer overflow discharges.

- Operation and Maintenance Costs - Category VI
  Annual equivalent operation maintenance and repair costs during 20-year planning period for alternatives to control selected pollutants in stormwater discharges.

The methodology for developing cost estimates is based on intensive work with the available technical literature. Also, a cost estimating model is developed from analysis of ten specific urbanized areas and the resulting transferable principles, relationships, and constants are applied to all urbanized areas.

The required methodology is summarized by the following scope of work elements:

- Pollutants to be Controlled
  The pollutants selected to be controlled must be few in number and must be selected on the basis of receiving water quality.

- Water Quality Standards
  The receiving water quality standards to be applied to the pollutants selected will be drawn from "Water Quality Criteria, 1972" EPA-R3-73-033, March, 1973, or "Quality Criteria for Water", July, 1976. In the event that no recommendation is made as to a parameter's receiving water quality requirement under these documents, "Guidelines for Developing or Revising Water Quality Standards Under the Federal Water Pollution Control Act Amendments of 1972" EPA, Water Planning Division, Planning and Standards Branch, Washington, D.C., amended April 1973, shall be used. These criteria provide information on the factors necessary to achieve the national interim goal for water quality stated in Section 101 (a) (2), to provide for the protection and recreation in and on the water to be achieved by July 1, 1983. Three different values of receiving water quality for each selected pollutant will be determined to provide for a range of receiving water quality effects associated with a range of costs.

- Costs of Alternative Technologies
  Cost functions and associated pollutant removal efficiences for alternative technologies for control of the selected pollutants will be identified from the literature. No original research on cost functions should be conducted.

- Total Pollutant Loads from Dry-Weather Sources
  A model will be developed for determining the total pollutant load from dry-weather point sources, for the selected pollutants, to the receiving water after the the establishment of 1983 discharge controls for dry weather point sources.

- Pollutant Loads from Wet-Weather Discharges and Runoff
  A model will be developed for determining the total pollutant load, for the selected pollutants, to the receiving waters from wet-weather combined sewer overflows, separate storm sewer, and nonsewered urbanized area runoff sources.

- Assimilative Capacity
  A model will be developed for determining the assimilative capacity of receiving waters for the selected pollutants based on simplified factors, such as type of receiving water, available dilution flow, and reaction coefficients of selected pollutants.

- Pollutant Control Levels Required for Alternative Receiving Water Criteria
  The models will be applied to determine the pollutant control levels required to achieve each of three alternative receiving water quality criteria.

- Types and Costs of Alternatives Necessary to Meet Water Quality Standards
  The type and costs of pollutant control alternative devices which meet each pollutant control level will be determined. The least cost control measures shall be determined for the alternate receiving water qualities. Cost will include both capital as well as operation, maintenance, and repair costs of the alternative control measure applicable during a 20-year planning period.

Copies of the draft report of October, 1976 were sent to each State Water Pollution Control Director, State Needs Survey Director, Interstate Water Pollution Control Commission, and EPA Regional Office, as well as numerous other individuals on October 22, 1976. Written comments on the draft report were requested by December 1, 1976.

A series of meetings was held in each EPA regional office November 8 through 23, 1976 to present the report and receive verbal comments. Written comments received prior to January 21, 1977 were incorporated in the final report.

Comment letters were received from 29 states, 1 territory, 3 interstate commissions, 3 cities, and 2 other organizations. Numerous other organizations were represented at the regional review meetings and offered verbal comments. The comment letters and the EPA responses are reproduced in Appendix D. The efforts of those who read and commented on the draft report are appreciated. It is hoped that the responses will be as helpful as the comments.

Section 2

ABATEMENT OBJECTIVES

Urbanization causes many changes in the water quality and hydrology of streams and other water bodies. As an area becomes more densely developed, there are changes in runoff water quality, in the total runoff volume, in the peak flow and base flow characteristics, and in the aesthetic values of the water body. Abatement objectives must be established to control these negative effects, while recognizing beneficial effects, such as ground water replenishment and stream flushing.

The abatement objectives are for mitigation and prevention of water quality problems due to combined sewer overflows and stormwater runoff from urbanized areas. In order to effectively meet this purpose, significant pollutants and their impact must be identified along with identification of receiving water standards.

2.1 SIGNIFICANT POLLUTANTS

From a detailed review of state and federal water quality criteria and available treatment and control techniques, the significant pollutants considered for the Categories V and VI needs estimate relate to solids, dissolved oxygen and bacteria. The following discusses these and other pollutants.

2.1.1 Solids

Particulate matter may cause detrimental effects on fish life, water supply, recreation and flooding potential. There are four basic effects of suspended solids on fish and fish food populations, namely by:

- acting directly on the fish swimming in water in which solids are suspended, and either killing them or reducing their growth rate, resistance to disease, etc.;
- preventing the successful development of fish eggs and larvae;
- modifying natural movements and migrations of fish; or,
- reducing the abundance of food available to the fish.

Although no specific limits exist for inert suspended solids below which damage to fisheries will not occur, the European Inland Fisheries Advisory Commission[4] stated the following conclusions relating to inert solids concentrations and satisfactory water quality:

- there is no evidence that concentrations of suspended solids less than 25 ppm have any harmful effects on fisheries;
- it should usually be possible to maintain good or moderate fisheries in waters which normally contain 25 to 80 ppm suspended solids. Other factors being equal, however, the yield of fish from such waters might be somewhat lower than with less than 25 ppm;
- waters normally containing from 80 to 400 ppm suspended solids are unlikely to support good freshwater fisheries, although fisheries may sometimes be found at the lower concentrations within this range; and,
- at the best, only poor fisheries are likely to be found in waters which normally contain more than 400 ppm suspended solids.

The Commission report also stated that exposure to several thousand mg/l for several hours or days may not kill fish and that other inert or organic solids may be substantially more toxic.

In raw water supplies, there are no specific criteria for suspended solids concentrations. However, turbidity is caused by suspended material and finished drinking water supplies have a maximum monthly average of 1 turbidity unit.[1] Thus, elevated suspended solids concentrations increase the difficulty and cost of providing an acceptable water supply. Total dissolved solids are generally limited to 500 mg/l by the U.S. Public Health Service for acceptable sources of raw water supply. These limits indirectly limit suspended solids concentrations in specific stream systems.

Turbid waters also interfere with recreational use and aesthetic enjoyment; and formation of sediment deposits contribute to flooding potential by restricting streamflows.

2.1.2 Dissolved Oxygen

Discharges of organic materials stimulate the growth of microorganisms which consume oxygen faster than it is naturally replenished. Dissolved oxygen, D.O., has always been a major constitutent of interest in water quality studies. It has generally been considered as significant in the protection of the aesthetic qualities of water, as well as for protection of fish and other aquatic life.

The aesthetic qualities of water require sufficient D.O. present to avoid the onset of septic conditions and the attendant odorous conditions.

The dissolved oxygen requirements for fish and other aquatic life are perhaps the most critical concern. It has been shown that fully developed fish will seldom be killed in nature solely by a dissolved oxygen as low as 3 mg/l when such level persists for only a period of moderate duration. However, mere survival of fish does not indicate successful long term production, since reproduction and growth are significantly interfered with by lowered water quality[5].

Fish growth has also been shown to be affected by fluctuating D.O. levels. Fish subjected to diurnally fluctuating D.O. concentrations grew at a rate approximately equivalent to that which occurred at the lower limit of the wide fluctuations. Thus, minimum concentrations are more important than average concentrations in restricting fish growth[6].

Acceptable dissolved oxygen levels have been based on minimum levels of 5 mg/l normally with 4 mg/l for brief periods for warm water fisheries and 6 mg/l normally with 5 mg/l for brief periods for cold water fisheries[2]. More recently, authors have proposed a variable limit based on natural seasonal minimum oxygen concentrations and the required degree of fishery protection with the additional inclusion of a 4 mg/l minimum for all waters[3].

Dissolved oxygen in waters used for water supply and recreation is desirable as an indicator of satisfactory water quality but is not necessarily required to produce a high quality finished water. Dissolved oxygen criteria for fish and aquatic life are sufficient for adequate protection of water supply sources and recreation uses.

2.1.3 Bacteria

The presence of excessive concentrations of objectionable microorganisms can impair the ability to utilize waters for water supply and recreational purposes. Microbiological indicators have been used to determine or indicate the safety of water uses and fecal coliform bacteria is used most often as an indicator of pollution.

The relationships between fecal coliform and pathogenic organisms are not well known. Similarly, the relationship between numbers of specific disease causing organisms in water and the potential for transmission of disease is not defined. The use to which the water is put, the type of water, and the geographical location all are factors to be weighed in determining safe microbiological criteria.

Regardless of shortcomings, fecal coliform densities have been used as criteria for indication of water quality degradation and a relative risk of disease transmission. Therefore, the use of fecal coliform must relate to the probable occurrence of known waterborne pathogens. Studies have shown that a sharp increase in the frequency of Salmonella detection occurs when fecal coliform densities are above 200 organisms per 100 ml of fresh water. The recovery of Salmonella in estuarine waters is lower than that in freshwaters[3].

Based on these observations, the fecal coliform densities in waters used for water supply or body contact recreations should not exceed a log mean of 200 per 100 ml based on not less than five samples taken over not more than a 30-day period, nor should more than 10 percent of the samples during any 30-day period exceed 400 per 100 ml.

2.1.4 Other Pollutants

Many other pollutants have been found in stormwater runoff by specific investigations, often at elevated concentrations[7]. Examples of these pollutants and their respective impacts are as follows:

Pollutant	Water Quality Impact
Nitrogen	Stimulation of aquatic growth and dissolved oxygen depletion.
Phosphorus	Stimulation of aquatic growth.
Dissolved Solids	Degradation of water supply sources.
Heavy Metals	Long term effects on aquatic life and degradation of water supply sources.
Pesticides	Long term effects on aquatic life.

Although these pollutants may cause significant water quality problems in specific areas, they have not been included in the proposed water quality criteria because of scarcity of both concentration and impact data and specificity of water quality problems.

2.2 WATER QUALITY CRITERIA

Water quality criteria to be applied to receiving stream standards must provide information on factors to achieve the interim water quality goals of P.L. 92-500. These goals are to provide for the protection and propagation of fish, shellfish, and wildlife as well as for recreational uses by July 1, 1983. Also, a lower standard was evaluated. The three alternative water quality criteria selected for this study are termed Aesthetics, Fish and Wildlife, and Recreation.

Most existing water quality criteria include provisions exempting "natural causes", and some specifically do not apply to "wet weather conditions".

These provisions generally make existing criteria unenforceable during periods of stormwater runoff. Additionally, criteria vary widely between states across the country. It was very difficult, therefore, to develop one set of criteria for nationwide application to streams receiving combined sewer overflows and stormwater runoff.

General wet weather criteria for application to all receiving waters is presented in Table 2.1. For the Aesthetics water quality criteria, only the general criteria applies. Additional specific criteria for Fish and Wildlife and Recreation water quality are presented in Table 2.2 and 2.3.

TABLE 2.1

GENERAL WET WEATHER CRITERIA FOR ALL WATER

All waters are to be aesthetically compatible to adjacent areas. All waters shall be free from oil, scum and floating debris associated with cultural activities in amounts sufficient to be unsightly.

All waters shall be free from materials associated with cultural activities which will settle and form significant sediment or sludge deposits that become unsightly or interfere with stream capacities.

NOTE: These criteria apply to all urbanized waters of the nation as a minimum. Applies to streams which can be documented as being intermittent or ephemeral and whose major use is aesthetic or drainage.

TABLE 2.2

FISH AND WILDLIFE WET WEATHER CRITERIA

Dissolved Oxygen:	A daily average of 5.0 mg/l and no less than 4.0 mg/l at all times.
pH:	Within the range of 6.0 - 8.5
Solids:	Suspended solids not be exceed a monthly average of 80 mg/l or a maximum value of 400 mg/l.

NOTE: These criteria shall apply to continuously flowing streams which can maintain a viable fishery.

TABLE 2.3

RECREATION WET WEATHER CRITERIA

Dissolved Oxygen:	A daily average of 5.0 mg/l and no less than 4.0 mg/l at all times.
pH:	Within the range of 6.0 - 8.5.
Solids:	Suspended solids not to exceed a monthly average of 80 mg/l or a maximum value of 400 mg/l.
Bacteria:	Fecal Coliform not to exceed a geometric mean of 200 per 100 ml and not to exceed 400 per 100 ml in more than 10% of the samples collected in any month.

NOTE: These criteria shall apply to continuously flowing streams which can provide full body contact recreation.

Section 3

TREATMENT AND/OR CONTROL FACILITIES

To date, there have been few full scale facilities constructed specifically for urban stormwater treatment. Therefore, cost and effectiveness data on specific treatment processes are scarce. Operation and maintenance cost data is almost non-existent due both to lack of treatment facilities and to the reporting procedures of public works agencies[8]. Recently, however, several reports have been completed which developed cost estimating procedures for stormwater treatment and/or control facilities[8, 9, 10].

Three of these recent reports were used extensively to develop cost estimating functions for the 1976 Needs Survey, Category V & VI. "Estimating Initial Investment Costs and Operating and Maintenance Requirements of Stormwater Treatment Processes"[8], a report prepared under sponsorship of the U.S. Environmental Protection Agency, developed data for estimating average initial investment costs and operation and maintenance requirements for stormwater overflow treatment plants ranging from about 5 to 200 mgd in capacity. Estimating data were included for 14 separate process functions associated with stormwater treatment plants and storage facilities.

"Assessment of the Impact of the Handling and Disposal of Sludge Arising from Combined Sewer Overflow Treatment"[9], another report sponsored by EPA, determined the characteristics of sludges from combined sewer overflow treatment and analyzed methods for the handling and disposal of the resulting sludges. Cost estimating methodologies were developed for required capital as well as operation and maintenance expenditures.

"An Evaluation of Streetsweeping Effectiveness in the Control of Nonpoint Source Pollution"[10], a report developed by the Catholic University of America, analyzed urban street sweeping programs under rainfall conditions for Washington, D.C. and for sweeping frequencies to determine the cost and effectiveness of street sweeping for water pollution control.

Many other reports sponsored by EPA's Office of Research and Development and other agencies were utilized to develop the efficiency and cost estimating models required by the 1976 Needs Survey.

3.1 EFFICIENCIES OF CONTROLS

From a review of the literature,[11] several treatment and/or control schemes for combined sewer overflows and urban stormwater runoff were developed. Pollutant removal efficiencies were estimated for each treatment scheme. The treatment or control option evaluated and the estimated pollutant removal efficiencies for each alternative are identified in Table 3.1. Flow schematics for each of the control options are depicted in Figures 3.1 through 3.5.

TABLE 3.1
ESTIMATED CONTROL OPTION EFFICIENCY

Treatment or Control Option	Efficiency (% Removal)		
	BOD_5	Sus. Solids	Fecal Coliform
I. Best Management Practices			
street sweeping, catch basin cleaning, construction practices, detention basins in developing area.	0-25	0-25	-
II. Screening-Swirl Concentration			
swirl concentrator, storage, raw wastewater pumping, screening (stationary type), flow measurement, misc.	0-25	0-25	-
III. Sedimentation			
storage, raw wastewater pumping, sedimentation, flow measurement, misc.	25-40	25-50	-
IV. Air Floatation w/Chemicals			
storage, raw wastewater pumping, rapid mix, chemical feed equip., air floatation, flow measurement, misc.	40-60	50-70	-
V. Flocculation-Sedimentation			
storage, raw pumping, chemical feed, rapid mix, flocculation, sedimentation, flow measurement, misc.	60-80	70-90	-
VI. Filtration			
storage, raw pumping, chemical feed, rapid mix, flocculation, sedimentation, flow measurement, misc.	80-95	90-98	-
VII. Disinfection			
gaseous chlorine storage & feeding to above options	-	-	99.9

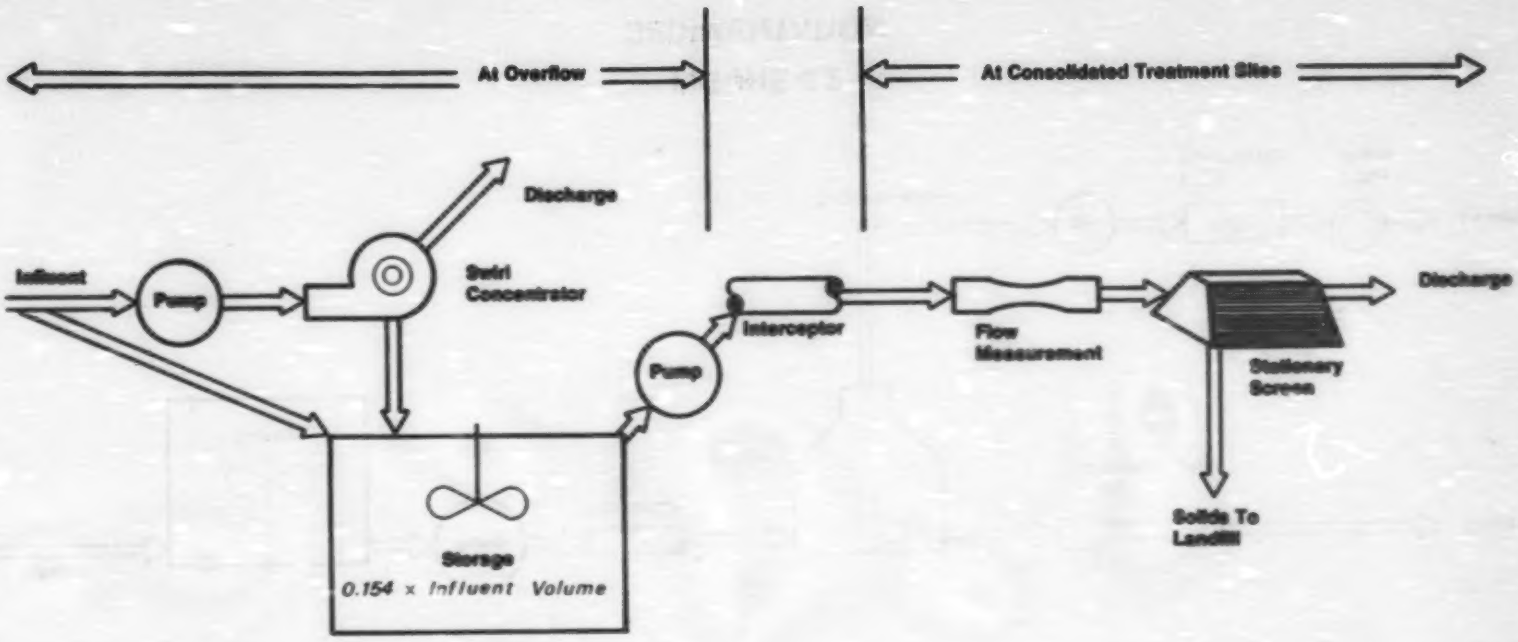
At Overflow
At Consolidated Treatment Sites
Discharge
Influent
Pump
Swirl Concentrator
Storage
0.154 × Influent Volume
Pump
Interceptor
Flow Measurement
Stationary Screen
Discharge
Solids To Landfill

FIGURE 3.1

SCREENING — SWIRL CONCENTRATOR

FLOW SCHEMATIC

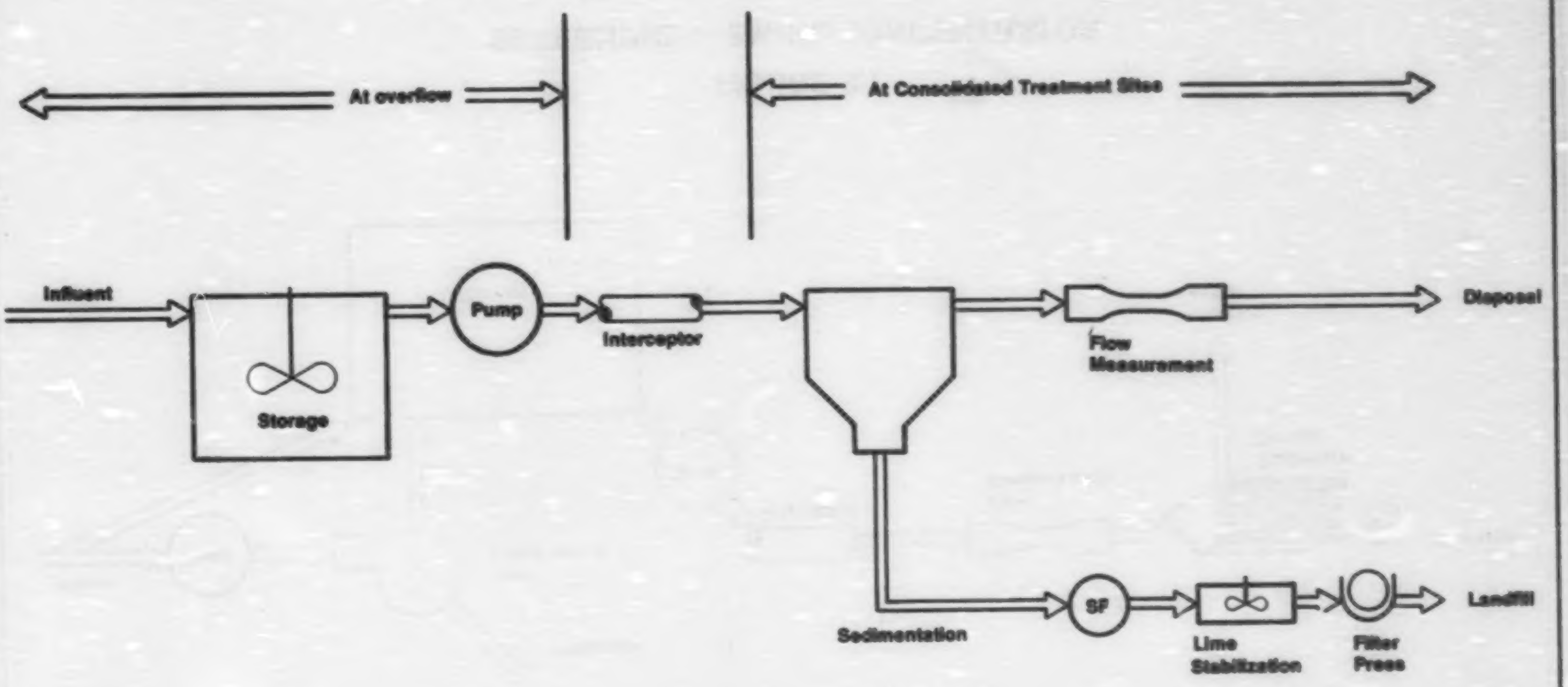
At overflow
At Consolidated Treatment Sites
Influent
Storage
Pump
Interceptor
Flow Measurement
Disposal
Sedimentation
SF
Lime Stabilization
Filter Press
Landfill

FIGURE 3.2
SEDIMENTATION
FLOW SCHEMATIC

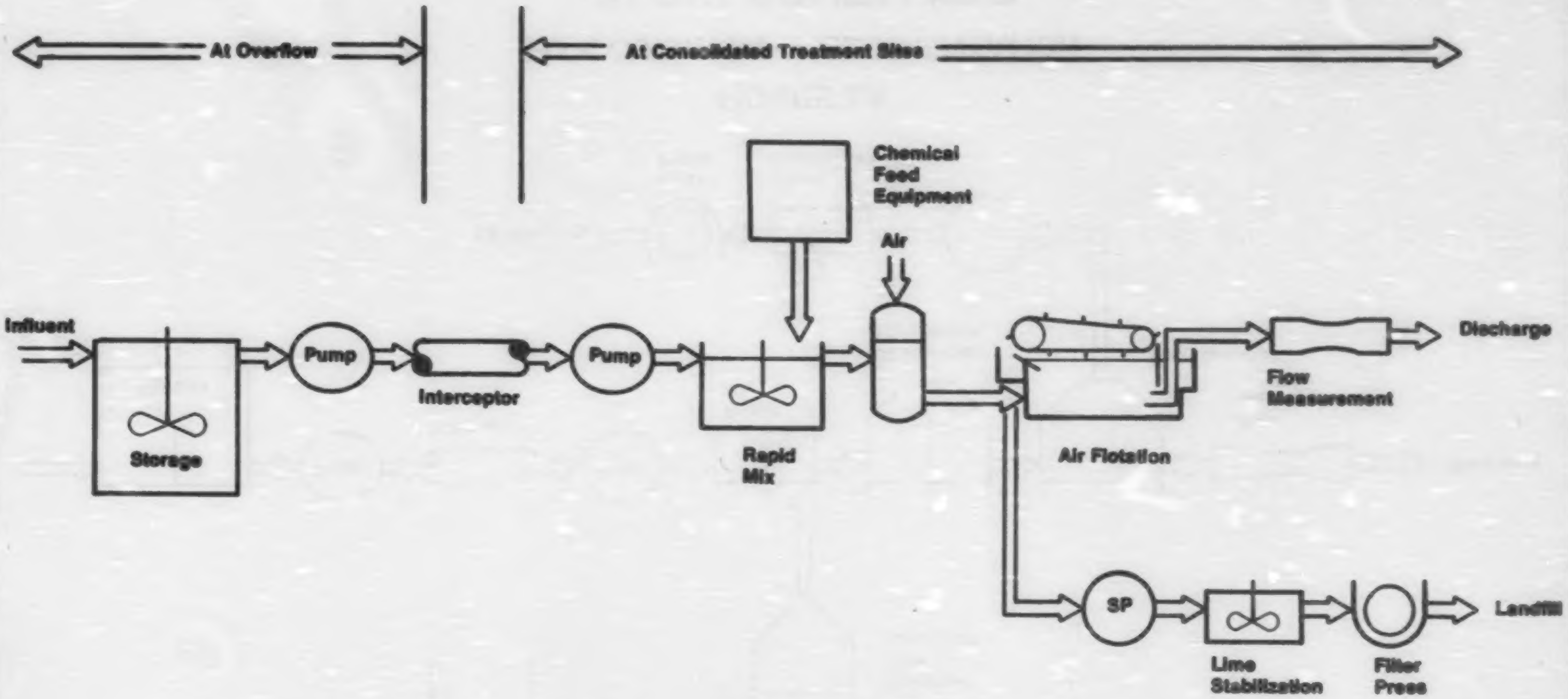
At Overflow
At Consolidated Treatment Sites
Influent
Storage
Pump
Interceptor
Pump
Chemical
Feed
Equipment
Rapid
Mix
Air
Air Flotation
Flow
Measurement
Discharge
SP
Lime
Stabilization
Filter
Press
Landfill

FIGURE 3.3
DISSOLVED AIR FLOTATION
FLOW SCHEMATIC

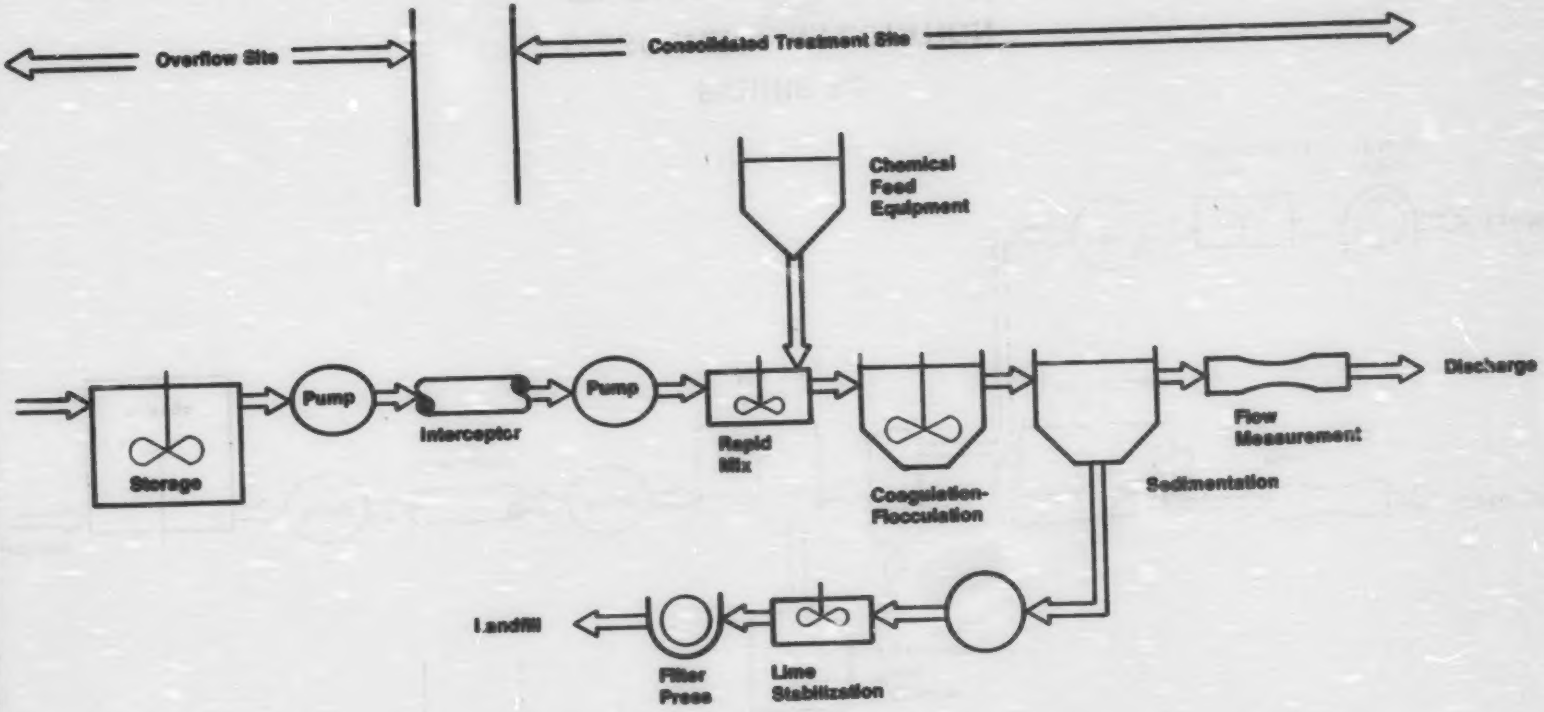
Overflow Site
Consolidated Treatment Site
Chemical Feed Equipment
Storage
Pump
Interceptor
Pump
Rapid Mix
Coagulation-Flocculation
Sedimentation
Flow Measurement
Discharge
Landfill
Filter Press
Lime Stabilization

FIGURE 3.4

FLOCCULATION — SEDIMENTATION

FLOW SCHEMATIC

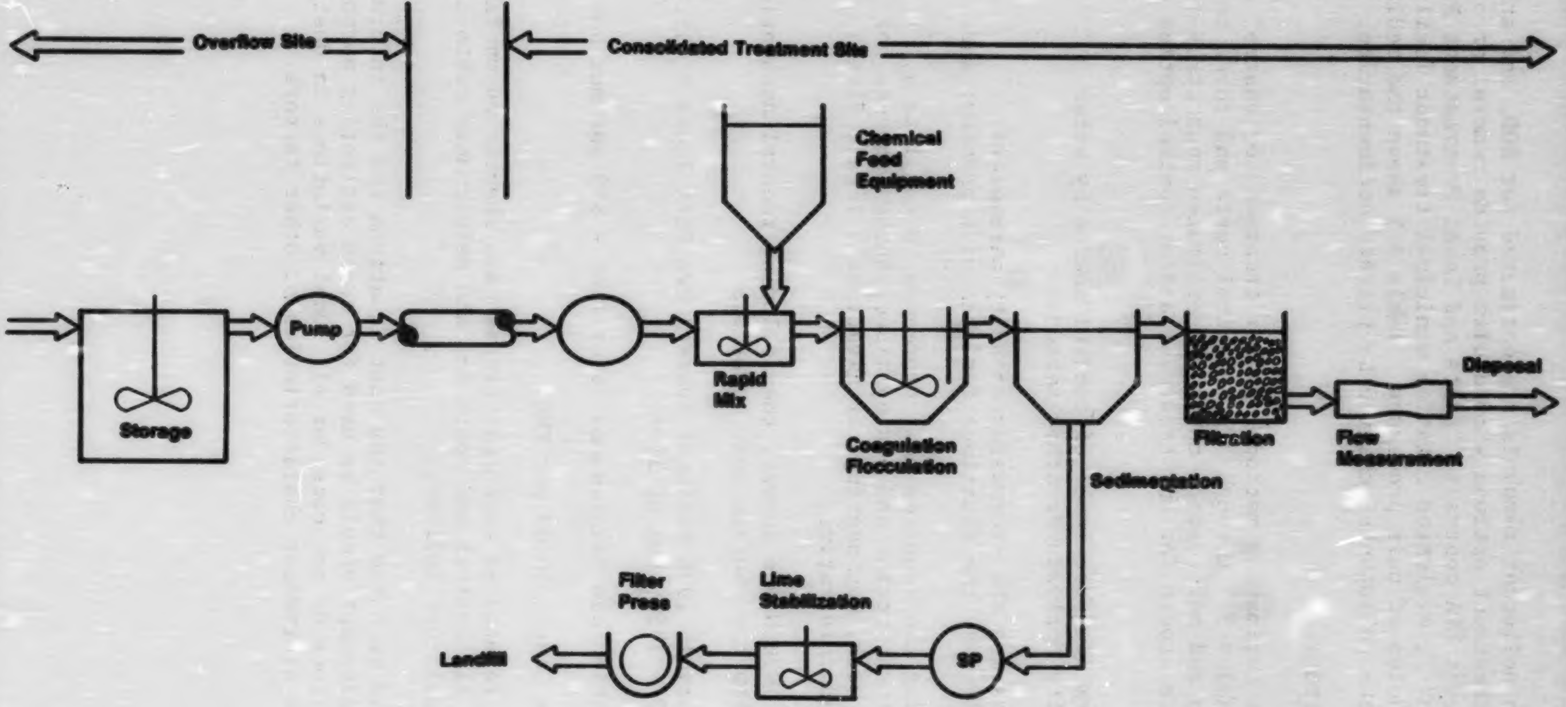
Overflow Site
Consolidated Treatment Site
Chemical Feed Equipment
Pump
Storage
Rapid Mix
Coagulation Flocculation
Sedimentation
Filtration
Flow Measurement
Disposal
Filter Press
Lime Stabilization
SP
Landfill

FIGURE 3.5
FILTRATION
FLOW SCHEMATIC

Although pollutant removals are estimated for BOD_5 and suspended solids only, the treatment options should also provide removal of other pollutants. A recent EPA contract, "State and Local Pretreatment Programs - Federal Guidelines"[12], evaluated existing municipal treatment facilities to determine effeciencies of unit processes. Table 3.2 shows the median removals of fourteen pollutants achieved by primary sedimentation.

3.2 COSTS OF CONTROLS

The cost estimating methodology for treatment or control options are detailed on Tables 3.3 through 3.9. Capital costs and three categories of operation and maintenance costs are estimated separately for each unit process. Total costs for any treatment and/or control option can be determined by:

- Determining the level of control needed by water quality analysis or other methods;
- Estimating the stormwater capacity parameters required by the equations for each unit process; and,
- Summing the required unit processes to complete a treatment option and adding miscellaneous amounts for site work, engineering, architectural, legal, fiscal and administrative.

For the 1976 Needs Survey, the following general assumptions were made to develop the average cost equations:

- January 1, 1976 National Average EPA Cost Index = 255.7 (1957 - 1959 base of 100);
- Operation and Maintenance Labor Cost = $10 per man hour;
- Power Cost = $0.03 per KWH.

Other assumptions related to each unit process are identified on Tables 3.3 through 3.9. All capital and operation and maintenance costs are adjusted by regional cost indices.

It should be noted that the cost equations and the information used in their development should be used for broad estimating purposes only. These equations do not consider all local variations in design criteria, specific stormwater characteristics or other factors.

TABLE 3.2

MEDIAN REMOVAL EFFICIENCY OF PRIMARY SEDIMENTATION

Pollutant	Median Percent Removal
Cadmium (total)	7
Chromium (total)	16
Lead	20
Mercury	21
Copper	19
Nickel	6
Zinc	25
Iron	37
Manganese	8
Ammonia	16
TOC	20
COD	19
Suspended Solids	52
BOD_5	28

TABLE 3.3
COST ESTIMATING METHODOLOGY
BEST MANAGEMENT PRACTICES

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)
Street Sweeping	Curb miles swept per year	$17.33 per curb mile for 20 year period	$5.46 per curb mile swept
Construction Practices	Land area under construction (acres)	-	$400 per acre under construction each year
Detention Basins	Runoff from design storm (mg)	$.50 per gallon of storage volume	2% of capital cost per year

TABLE 3.4
COST ESTIMATING METHODOLOGY
SCREENING - SWIRL CONCENTRATOR

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Administration		-	$200\ TR^{0.463}$	$75\ TR^{0.471}$	-
Laboratory	400 samples per year	-	8600	2200	-
Yardwork		-	$875\ PR^{0.798}$	$57\ PR^{0.838}$	-
Raw Wastewater Pumping		$98,800\ PF^{0.602}$	$2500+1930PF^{0.468}$	60 PF	180 PF
Swirl Concentrator		$13,309\ PF^{0.598}$	$2571\ PF^{0.214}$	1760	-
Storage (CSO) (15.4% of runoff stored)	70% concrete covered, 30% concrete uncovered storage	$34,790\ VR^{0.598}+$ $60,440\ VR^{0.803}$	$415\ VR^{0.470}$	$227\ VR^{0.400}$	$5.4\ VR^{0.510}$
Pumping		$150,000\ PR^{0.602}$	$2500+1930PR^{0.468}$	60 PR	180 PR
Stationary Screens		$13,110\ TR^{0.955}$	$1530\ TR^{0.466}$	$678\ TR^{0.281}$	-
Flow Measurement		$3130\ TR^{0.484}$	-	-	-
Miscellaneous		25% of above items	-	-	-

Key:
PF - Peak Flow Rate (mgd)
VR - Volume of Runoff (mg)
TR - Consolidated Treatment Rate (mgd)
PR - Pumping Rate from Storage (mgd)

TABLE 3.5
COST ESTIMATING METHODOLOGY
SEDIMENTATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Administration	-	-	$200\ TR^{0.463}$	$75\ TR^{0.471}$	-
Laboratory	400 samples per year	-	8600	2200	-
Yardwork	-	-	$875\ PR^{0.798}$	$57\ PR^{0.838}$	-
Storage - CSO	70% concrete covered, 30% concrete open	$106,500\ VR^{0.598}+$ $271,500\ VR^{0.803}$	$1000\ VR^{0.470}$	$480\ VR^{0.400}$	$14\ VR^{0.510}$
- Stormwater	50% Earthen 50% concrete open	$15,200 VR^{0.717}+$ $177,500\ VR^{0.598}$	$1000\ VR^{0.470}$	$480\ VR^{0.400}$	$14\ VR^{0.510}$
Raw Wastewater Pumping	-	$150,000\ PR^{0.602}$	$2500+1930\ PR^{0.468}$	60 PR	180 PR
Sedimentation	1,500 gpd/ft^2	$43,120\ TR^{0.817}$	$2900\ TR^{0.732}$	$1229\ TR^{0.207}$	$6.8\ TR^{0.913}$
Sludge Pumping	-	$247,655\ TR^{0.503}$	$1790\ TR^{0.426}$	$92\ TR^{0.642}$	7.5 TR
Sludge Disposal	-	$50,112\ TR^{0.698}$	8580 TR	-	-
Flow Measurement	-	$3130\ TR^{0.484}$	-	-	-
Miscellaneous	-	25% of above items	-	-	-

Key:
PR = Pumping Rate from Storage(mgd)
PF = Peak Flow Rate (mgd)
VR = Volume of Runoff (mg)
TR = Consolidated Treatment Rate (mgd)

TABLE 3.6
COST ESTIMATING METHODOLOGY
DISSOLVED AIR FLOATATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Administration	-	-	200 $TR^{0.463}$	75 $TR^{0.471}$	-
Laboratory	400 samples per year	-	8600	2200	-
Yardwork	-	-	875 $PR^{0.798}$	57 $PR^{0.838}$	-
Storage - CSO	70% concrete covered 30% concrete open	106,500 $VR^{0.598}$ + 271,500 $VR^{0.803}$	1000 $VR^{0.470}$	480 $VR^{0.400}$	14 $VR^{0.510}$
- Stormwater	50% Earthen 50% concrete open	15,200 $VR^{0.717}$ + 177,500 $VR^{0.598}$	1000 $VR^{0.470}$	480 $VR^{0.400}$	14 $VR^{0.510}$
Raw Wastewater Pumping	-	150,000 $PR^{0.602}$	2500+1930 $PR^{0.468}$	60 PR	180 PR
Rapid Mixing	G=300 T_d = 2 min.	5,343 $TR^{0.724}$	85 $TR^{0.884}$	26 $TR^{0.698}$	54 TR
Chemical Feed	up to 75 mg/1 dosage	48,000 $TR^{0.611}$	3465 $TR^{0.332}$	36 $TR^{0.662}$	20 $TR^{0.860}$
Air Floatation	3600 gpd/ft^2	147,830 $TR^{0.830}$	2700 $TR^{0.618}$	1915 $TR^{0.203}$	2220 TR
Sludge Pumping	-	247,655 $TR^{0.503}$	1790 $TR^{0.426}$	92 $TR^{0.642}$	7.5 TR
Sludge Disposal	-	50,112 $TR^{0.608}$	8580 TR	-	-

TABLE 3.6 (Con't)

COST ESTIMATING METHODOLOGY
DISSOLVED AIR FLOATATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Flow Measurement	-	3130 $TR^{0.484}$	-	-	-
Miscellaneous	-	25% of above items	-	-	-

Key: PF = Peak Flow Rate (mgd)
VR = Volume of Runoff (mg)
TR = Consolidated Treatment Rate (mgd)
G = Mean Velocity Gradient (sec^{-1})
T_d = Detention Time (min)
PR = Pumping Rate from Storage (mgd)

TABLE 3.7
COST ESTIMATING METHODOLOGY
FLOCCULATION--SEDIMENTATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Administration	-	-	200 $TR^{0.463}$	75 $TR^{0.471}$	-
Laboratory	400 samples per year	-	8600	2200	-
Yardwork	-	-	875 $PR^{0.798}$	57 $PR^{0.838}$	-
Storage - CSO	70% concrete covered 30% concrete open	106,500 $VR^{0.598}$+ 271,500 $VR^{0.803}$	1000 $VR^{0.470}$	480 $VR^{0.400}$	14 $VR^{0.510}$
- Stormwater	50% Earthen 50% concrete open	15,200 $VR^{0.717}$+ 177,500 $VR^{0.598}$	1000 $VR^{0.470}$	480 $VR^{0.400}$	14 $VR^{0.510}$
Raw Wastewater Pumping	-	150,000 $PR^{0.602}$	2500+1930 $PR^{0.468}$	60 PR	180 PR
Chemical Feed	up to 75 mg/1 dosage	48,000 $TR^{0.611}$	3465 $TR^{0.332}$	36 $TR^{0.662}$	20 $TR^{0.86}$
Rapid Mix	G=300 T_d = 2 min	5,343 $TR^{0.724}$	86 $TR^{0.884}$	26 $TR^{0.698}$	54 TR
Flocculation	G=110 T_d = 30 min	19,420 $TR^{0.612}$	230 TR	140 $TR^{0.624}$	54 TR
Sedimentation	1500 gpd/ft^2	43,120 $TR^{0.817}$	2900 $TR^{0.732}$	1230 $TR^{0.207}$	6.8 $TR^{0.913}$

TABLE 3.7 (con't)
COST ESTIMATING METHODOLOGY
FLOCCULATION-SEDIMENTATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Sludge Pumping	-	247,655 $TR^{0.503}$	1790 $TR^{0.426}$	92 $TR^{0.642}$	7.5 TR
Sludge Disposal	-	50,112 $TR^{0.698}$	8580 TR	-	-
Flow Measurement	-	3,130 $TR^{0.484}$	-	-	-
Miscellaneous	-	25% of above items	-	-	-

Key:
PF = Peak Flow Rate (mgd)
VR = Volume of Runoff (mg)
TR = Consolidated Treatment Rate (mgd)
G = Mean Velocity Gradient (sec^{-1})
T_d = Detention Time (min)
PR = Pumping Rate from Storage (mgd)

TABLE 3.8
COST ESTIMATING METHODOLOGY
FILTRATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Administration	-	-	$200\ TR^{0.463}$	$75\ TR^{0.471}$	-
Laboratory	400 samples per year	-	8600	2200	-
Yardwork	-	-	$875\ PR^{0.798}$	$57\ PR^{0.838}$	-
Storage - CSO	70% concrete covered 30% concrete open	$106{,}500\ VR^{0.598}$ + $271{,}500\ VR^{0.803}$	$1000\ VR^{0.470}$	$480\ VR^{0.400}$	$14\ VR^{0.510}$
- Stormwater	50% Earthen 50% concrete open	$15{,}200\ VR^{0.717}$ + $177{,}500\ VR^{0.598}$	$1000\ VR^{0.470}$	$480\ VR^{0.400}$	$14\ VR^{0.510}$
Raw Wastewater Pumping	-	$150{,}000\ PR^{0.602}$	$2500+1930PR^{0.468}$	60 PR	180 PR
Chemical Feed	up to 75 mg/l	$48{,}000TR^{0.611}$	$3465\ TR^{0.332}$	$36\ TR^{0.662}$	$20\ TR^{0.86}$
Rapid Mix	G=300 T_d = 2 min	$5{,}343\ TR^{0.724}$	$86\ TR^{0.884}$	$26\ TR^{0.698}$	54 TR
Flocculation	G=110 T_d = 30 min	$19{,}420\ TR^{0.612}$	230 TR	$140\ TR^{0.624}$	54 TR
Sedimentation	1500 gpd/ft^2	$43{,}120\ TR^{0.817}$	$2900\ TR^{0.732}$	$1230\ TR^{0.207}$	$6.8\ TR^{0.913}$

TABLE 3.8 (con't)
COST ESTIMATING METHODOLOGY
FILTRATION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Filtration	10 gpm/ft^2	104,940 TR$^{0.736}$	22780+24 TR	761 TR$^{0.256}$	3.8 TR
Sludge Pumping	-	247,655 TR$^{0.503}$	1790 TR$^{0.426}$	92 TR$^{0.642}$	7.5 TR
Sludge Disposal	-	50,112 TR$^{0.698}$	8580 TR	-	-
Flow Measurement	-	3130 TR$^{0.484}$	-	-	-
Miscellaneous	-	25% of above items	-	-	-

Key:
PR = Pumping Rate from Storage (mgd)
PF = Peak Flow Rate (mgd)
VR = Volume of Runoff (mg)
TR = Consolidated Treatment Rate (mgd)
G = Mean Velocity Gradient (sec^{-1})
T_d = Detention Time (min)

TABLE 3.9
COST ESTIMATING METHODOLOGY
DISINFECTION

Process Function	Design Parameters	Capital Cost ($)	Operation and Maintenance Cost ($/Year)		
			Labor	Supplies	Power
Rapid Mix	$G=300$ $T_d = 2$ min	$5,343\ TR^{0.724}$	$86\ TR^{0.884}$	$26\ TR^{0.698}$	54 TR
Gaseous Chlorination	up to 7 mg/l dosage	63,040 + 5,190 TR	$1,780\ TR^{0.597}$	$1134\ TR^{0.690}$	-
Miscellaneous	-	25% of above items	-	-	-

Key: PF = Peak Flow Rate (mgd)
VR = Volume of Runoff (mg)
TR = Consolidated Treatment Rate (mgd)
G = Mean Velocity Gradient (sec^{-1})
T_d = Detention Time (min)

PART I

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PART II

SITE STUDIES

Section 4

SITE STUDY PROCEDURE AND ASSUMPTIONS

A major portion of this study is concerned with the analysis of hydrologic data, waste loading data, and receiving water impact data for ten selected sites located throughout the United States. The results of these site studies are then used to define design criteria, and to develop generalized relationships and methods which were applied to 320 urbanized areas to produce the national needs estimate.

Central to the site studies is the analysis of receiving water impact based on wet weather loads generated by the selected urban area, for a given design storm. Data generated by the ten site specific analyses are used to develop a generalized relationship between urban area characteristics, receiving water characteristics and the degree of treatment required for urban runoff and combined sewer overflow. This generalized relationship is then used, in part, as a basis for the projection of national needs for the control of urban runoff and combined sewer overflow. Thus, the selection of the ten study sites and subsequent impact analyses are important to the overall results of the project.

Part of the site selection task was the development of rational criteria which were used as a guide in the selection of the ten study sites in order to insure the analysis of a representative range of conditions. These criteria are intended to consider all relevent parameters and to weight these parameters according to their importance.

4.1 PRIMARY CRITERIA FOR SITE SELECTION

The following are the primary criteria applied to the selection of the ten study sites:

1. Geographic distribution - study sites should be distributed throughout the U.S.
2. Size Distribution - study sites should be representative of the full range of urban population centers.
3. Several sites should have combined sewer systems and the remainder should be stormwater only.
4. The sites selected should have all or most of the following data available.

a. Water quality of stormwater/combined sewer runoff data including: BOD_5, COD, Nitrogen (NO_2^-, TKN), SS and coliforms.

b. Drainage area, level of development (percent impervious area) slope, soil type, etc. for tributary watershed.

c. Continuous rainfall data at or near the site.

d. Low flow data for receiving water.

e. Water quality data for receiving water for low flow conditions, including: DO, Temperature, SS, Coliforms and salinity.

4.2 SECONDARY CRITERIA FOR SITE SELECTION

Secondary criteria applied to the selection of the ten study sites were:

1. Representative number (one or two) with discharge to an estuary.
2. Representative number (one or two) with discharge to a lake.
3. Preference to designated 208 areas to allow future updating of study.

4.3 SITES CONSIDERED

A literature review was undertaken to identify cities where previous urban runoff or combined sewer investigations had been conducted. In general, cities which have been the subject of such investigations could be expected to have some site specific demographic, hydrologic and water quality data available in easily obtainable and usable form. Only completed projects which resulted in a published report were considered. Table 4.1 presents a list of cities with urban runoff or combined sewer overflow data available. Each of these cities was then considered relative to the selection criteria outlined previously in order to arrive at ten selected study sites.

4.4 SITES SELECTED FOR ANALYSIS

The data base for each of the 26 cities listed in Table 4.1 was examined and those cities with the greatest amount of information

TABLE 4.1

PARTIAL LIST OF CITIES WITH URBAN RUNOFF OR COMBINED SEWER OVERFLOW DATA

City	Combined Separate	No. of Sites With Data
Ann Arbor, Michigan	S	1
Castro Valley, California	S	1
Des Moines, Iowa	S,C	2
Durham, North Carolina	S	2
Los Angeles, California	S	1
Madison, Wisconsin	S	1
New Orleans, Louisiana	S	1
Roanoke, Virginia	S	2
Sacremento, California	S, C	2
Tulsa, Oklahoma	S	15
Washington, D. C.	S, C	2
Cincinnati, Ohio	S, C	3
Detroit, Michigan	S, C	3
Atlanta, Georgia	S, C	2
West Lafayette, Indiana	S	1
Lubbock, Texas	S	1
New York, New York	S	1
Bucyrus, Ohio	C	3
Berkeley, California	C	1
Brooklyn, New York	C	1
Kenosha, Wisconsin	C	1
Milwaukee, Wisconsin	C	1
Racine, Wisconsin	C	1
San Francisco, California	C	2
Philadelphia, Pennsylvania	C	1
Portland, Oregon	C	1

available were considered first. The locations of these cities were then plotted on a base map to consider geographic distribution. Population of the city and the associated Standard Metropolitan Statistical Area were also considered along with receiving water characteristics (i.e., stream, lake or estuary) in the final selection. The ten study sites selected are located in the following cities: Atlanta, Georgia; Des Moines, Iowa; Durham, North Carolina; Lubbock, Texas; Milwaukee, Wisconsin; Philadelphia, Pennsylvania; Portland, Oregon; Roanoke, Virginia; San Francisco Bay Area, California; and Tulsa, Oklahoma. The geographic distribution of the study sites is illustrated on Figure 4.1.

The final selected sample includes: one east coast estuary; one west coast estuary; one Great Lakes site; six sites with combined sewer discharges; four sites with only storm water discharges; receiving streams with large base flows; and receiving streams with small base flows. Also the geographic distribution of the sites as shown on Figure 4.1 compares reasonably well with the distribution of population across the United States. Therefore, the ten selected study sites represent the range of conditions which are reasonably likely to be encountered on a nation-wide basis.

4.5 SCOPE OF SITE STUDIES

Each study site was analyzed individually in order to quantitatively estimate the impact of stormwater runoff and combined sewer overflow on receiving water quality. The same general procedure was applied to each site in order to obtain comparable results. The exact procedure employed at each of the ten sites was dependent upon the data available at that site since a given parameter or demographic characteristic may have been measured and reported for one city and not for another. Preference was always given to site specific data. However, where such observed data were unavailable, a reasonable value for the parameter was estimated or assumed and the analysis was carried out including these assumptions.

Receiving water quality, as measured by suspended solids production and dissolved oxygen residual, are of interest in the impact analysis, since one or the other may control the degree of treatment required for a given situation. However, since suspended solids are a conservative substance, they can be addressed in a straight-forward manner when determining the level of treatment required to meet selected criteria. Dissolved oxygen residual on the other hand, is a more complex nonconservative constituent which depends on a number of factors. Therefore, the emphasis of the ten site studies is on determination of the dissolved oxygen response of each urban area/receiving water system. Estimated suspended solids production for each study site are, however, reported in Appendix A, and suspended solids considerations are included in the computation of national needs.

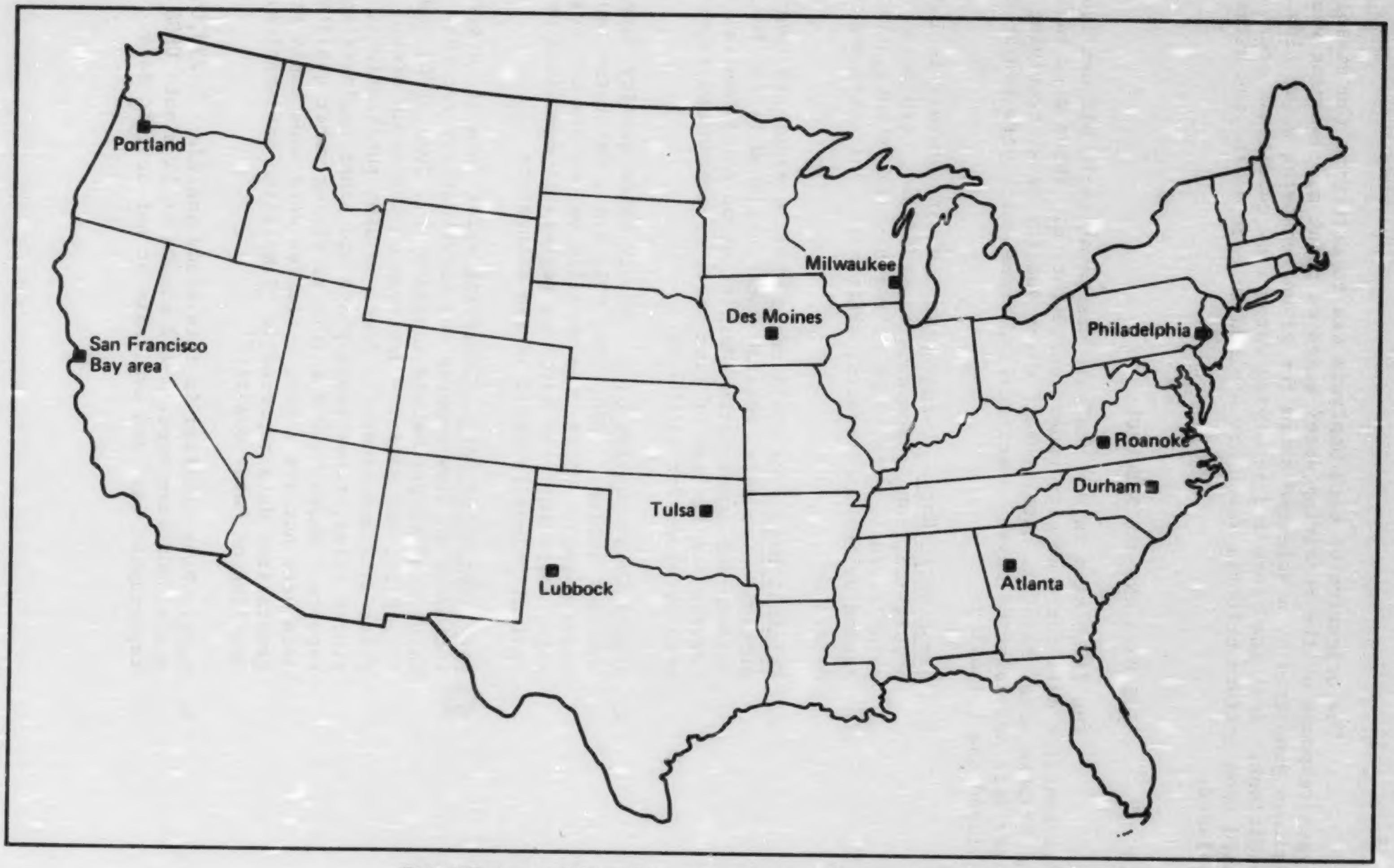
Portland
San Francisco Bay area
Milwaukee
Des Moines
Philadelphia
Roanoke
Durham
Tulsa
Lubbock
Atlanta

FIGURE 4.1. LOCATION OF SELECTED STUDY SITES.

The objective of each analysis was to determine the dissolved oxygen response of the receiving water based on point and nonpoint waste loadings generated by a selected storm for given receiving water flow conditions. Both the storm and receiving water flow conditions are based upon uniform criteria which are applied to each of the ten sites analysed.

4.6 SITE DATA AND WASTE SOURCES

The first step in the analysis was to assemble all available site specific data for each city under consideration. These data include demographic data, rainfall data, runoff water quality data, receiving water data and selected maps. Specifically, items which were sought out included the following:

1. Demographic Data. Demographic data of interest include: population, population density, land use, curb miles of major streets, curb miles of residential streets, area served by combined sewers, urban area, and total watershed area.

2. Rainfall Data. Rainfall records of interest are hourly precipitation data, obtained and published by the National Oceanic and Atmospheric Administration environmental data service. A minimum of five years of continuous records were obtained for each site.

3. Runoff Water Quality Data. Runoff water quality data of interest include: BOD, TKN, NO_2^-, S.S., Coliforms, and heavy metals. Where site specific values are not available, estimates were based on regression equations and typical values reported in the literature.

4. Receiving Water Data. Receiving water data of interest include both flow records and water quality records. Water quality parameters include: DO, Temp, BOD, TKN, NO_2^-, S.S., and salinity upstream of the urban area. These data are generally found in USGS publications, storet files, river basin plans and other engineering reports. Where site specific receiving water quality data were not available, estimates were made based on generalized data reported in "Simplified Mathematical Modeling of Water Quality"[1]

5. Maps. Maps utilized in this study include: 1:250,000 scale USGS base maps, 7-1/2 minute or 15 minute USGS topographic maps and available street or road maps.

Once the above information is assembled, then an appropriate receiving water is identified. The receiving water is generally the main stream which drains the urban area or a significant portion of the urban area. This is an important concept since all analyses were carried out on a hydrologic unit basis. That is, only waste sources tributary to the receiving water are considered in the impact evaluation. For example, in the case of Roanoke, the whole of the urban area is drained by the Roanoke River and, therefore, all urban runoff will enter the receiving water. In the case of Atlanta, the urban area is tributary to several river systems and only one, the Chattahoochee River, was selected for analysis. Therefore, only those waste sources tributary to the Chattahoochee are considered in the analysis.

4.7 CONCEPTUAL SKETCH OF STUDY SITE

The next step in the general site study procedure was to prepare a base map of the study site showing the actual location of all known waste sources discharging to the receiving waters. These sources will include wastewater treatment plants, combined sewer overflow, storm sewers, local runoff, and streamflow directly upstream of the urban area.

Once the actual situation is known, then a conceptual sketch or model of the urban area receiving water system can be prepared. This sketch illustrates a simplified representation of the urban area. Appropriate simplifications included combining adjacent wastewater treatment plants into one point source, combining major and minor combined sewer overflow points into one or more discharge points, and uniformly distributing urban runoff. The geometry of the stream channel was also idealized by considering a rectangular channel of mean width and depth as determined from available maps and hydraulic computations.

Figure 4.2 illustrates a typical conceptual sketch of an urban area receiving water system. Actual conceptual sketches of each study site are given in Appendix A.

The example shown in Figure 4.2 illustrates combined sewer overflow as discrete point sources, which is generally the case. However, in some situations combined sewer overflow were represented as distributed loads in a manner similar to urban runoff. This was done when the number of overflow points was large and generally within the same area, such as in the case of Milwaukee. Other waste sources were included, such as industrial wastewater treatment plants when information regarding flows and waste strengths were known.

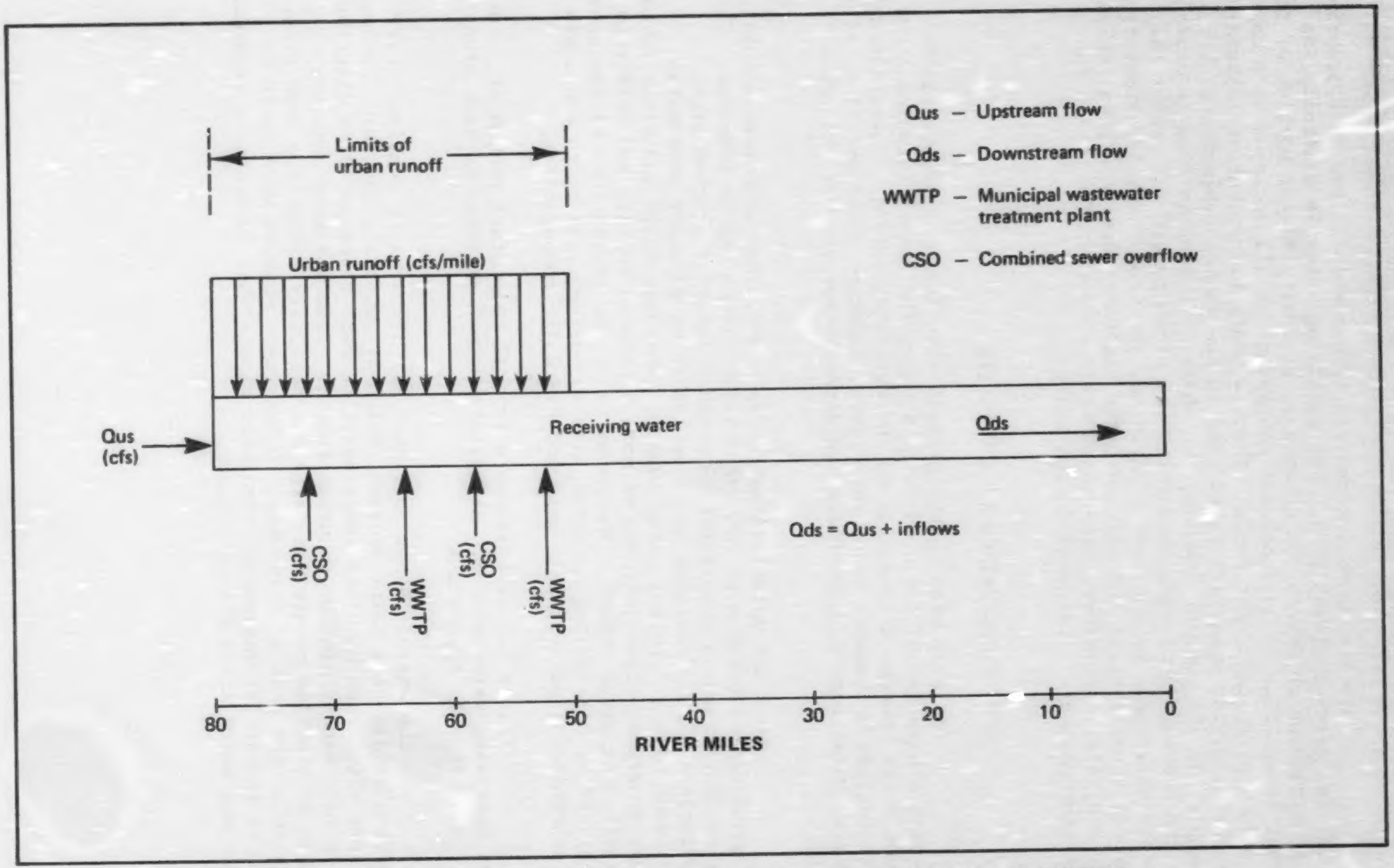
Qus – Upstream flow
Qds – Downstream flow
WWTP – Municipal wastewater treatment plant
CSO – Combined sewer overflow
Limits of urban runoff
Urban runoff (cfs/mile)
Qus (cfs)
Receiving water
Qds
CSO (cfs)
WWTP (cfs)
CSO (cfs)
WWTP (cfs)
Qds = Qus + inflows
80
70
60
50
40
30
20
10
0
RIVER MILES

FIGURE 4.2. CONCEPTUAL SKETCH OF URBAN AREA RECEIVING WATER SYSTEM.

4.8 DESIGN STORM

The selection of an appropriate design storm is an important part of any stormwater or combined sewer overflow impact analysis or stormwater facilities design. This selection will largely determine the size of a suitable detention facility and the required capacity of treatment works. Therefore, the design storm magnitude determines, to a great extent, the cost of pollution abatement.

Ideally, the facilities design criteria should be determined by continuous hydrologic simulation of the subject hydrologic unit to establish site specific relationships between facilities' capacities and overall pollution abatement. Since the hydrologic process is stochastic in nature, it follows that the pollution abatement process is a stochastic process. Therefore, the problem should be addressed from a probabilistic framework in order to assure realistic analysis. Once relationships between alternative pollution abatement facilities and probable improvement in water quality (expressed as expected value of number or duration of exceedences of wet weather water quality criteria per unit time) are known, then relationships between cost and probable improvement in water quality can be derived. Only then will actual trade-offs be apparent and only then can rational design decisions be made.

In general, such hydrologic, probabilistic and economic analyses have not been made and the accepted procedure has been to "select" a design rainfall event and to proceed with the design of facilities. In many cases, the concept of an extreme rainfall event has been applied. For example, a given detention facility may be designed to store the runoff from a 5-year, 24-hour storm. If this detention facility is located in a region which receives 100 days with rain per year, then in a 5-year period 500 rainfall events will have been recorded. In any given 5-year period, it is probable that only one rainfall event will exceed the capacity of the detention facility and 499 events, or 99.8 percent, will not. Thus, a very high level of treatment, probably on the order of 99 percent of all runoff, will be achieved. The exact percentage will depend upon not only the detention capacity, but also on the treatment rate and on the random variable, time between storms.

The magnitude of rainfall events is not only random, but tends to be exponentially distributed. That is, the majority of rain storms occur as small showers or long periods of low intensity rainfall, with infrequent storms producing large volumes of rainfall. When designing storm drainage or flood protection facilities, it is appropriate to design for flow rates produced by extreme rainstorms. When designing pollution abatement facilities, such extreme design criteria are probably not warranted.

As an example, consider the Atlanta area which experiences 115 days with rain per year and has a 5-year, 24-hour storm rainfall depth of approximately 5.0 inches. If storage and treatment were provided for the 5-year storm level, then required storage would be such that all runoff from 99.83 percent of all storms would be stored. As an alternative, assume that the criteria were to store and treat all runoff produced by 80 percent of the rainstorms, instead of 99+ percent. Then the depth of the design storm would be 0.74 inches, or about 15 percent of the 5-year value, yet a very substantial portion of the runoff would receive treatment at a small fraction of the cost.

It is beyond the scope of this investigation to undertake complex hydrologic, stochastic and economic analyses of the ten study sites to determine the optimum level of design at each. However, we believe that from a water quality standpoint, design for extreme storm events will generally not be cost-effective. Therefore, we have selected design storm and related criteria based on the following assumptions:

1. The random variable rainfall depth is exponentially distributed.

2. Combined sewer overflow involves the discharge of untreated municipal wastewater and, therefore, requires a higher level of control to meet receiving water quality criteria than is required for stormwater runoff.

3. Allowable frequency of exceedance of wet weather dissolved oxygen criteria (5.0 mg/l or less) for fish and wildlife waters is on the order of twice per year.

4. Allowable frequency of exceedance of wet weather fecal coliform criteria for recreation waters is on the order of twice per year.

The design storm criteria selected are: the 80th percentile storm for all stormwater facilities; the 90th percentile storm for treatment of combined sewer overflow to meet the aesthetics and fish and wildlife criteria; and the 98th percentile storm for treatment of combined sewer overflow to meet the recreation criteria. Thus, the design storm is defined as that depth of rainfall at which the cummulative frequency of observed rainfall depths is 80, 90, or 98 percent, dependent upon the type of urban runoff and receiving water quality to be achieved. These values were computed for each urbanized area.

The computation procedure was to first compute the mean depth of rainfall per storm at each site by the following equation:

$$MRF = ARF/MNS \qquad (4.1)$$

Where:

MRF = Mean depth of rain per event
ARF = Mean annual rainfall
MNS = Mean number of storms per year

The mean annual rainfall and the number of storms per year were obtained by analysis of 5 years of hourly rainfall data. Rain storm events were considered independent when separated by a dry period of 6 hours or more.

Assuming that rainfall depths are exponentially distributed, then the design storm depth can be computed as follows:

$$DS_x = K_x \, MRF \qquad (4.2)$$

Where:

DS_x = Design rainfall depth based on x percentile storm
K_x = A factor which converts the MRF to 80, 90, or 98 percentile storm depth ($K_{80} = 1.61$; $K_{90} = 2.30$; and $K_{98} = 3.91$)

The design duration of the storm event was determined by linear regression of depth of rainfall against duration of rainfall. Once a regression line for a given data set was established, then the expected value of the duration corresponding to the design depth was computed. This value was then used as the duration of the design storm.

Knowing the depth and duration of the design storm, several parameters related to the capacity of the required facilities can be determined. The first is the volume of storage required, which is assumed equal to the volume of runoff produced by the design storm, and is computed by the following equation:

$$DVS = DS \times C \times DA \times 0.02715 \qquad (4.3)$$

Where:

DVS = Design storage volume in million gallons
DS = Design rainfall depth in inches
C = Runoff coefficient
DA = Drainage area, tributary to storage facility, in acres

The required treatment rate is simply equal to the total volume in storage (DVS) divided by an appropriate emptying time. For the purposes of this study, the emptying time was taken as the duration of the design storm plus the mean time between rain storms (TBS), which was determined from analysis of the hourly rainfall data for each site. The design flow rate is computed as follows:

$$TR = DVS/(SD + TBS) \qquad (4.4)$$

Where:

TR = Design flow rate of treatment facility in mgd
SD = Duration of design storm in days
TBS = Time between summer storms in days

Once criteria are selected for the design of storage and treatment facilities, a storage treatment system is defined. The overall performance of such a system depends not only on rainfall characteristics which are utilized in the design criteria but also on the receiving water streamflow, quantity and quality, which like rainfall are random variables. In some cases, upstream receiving water streamflow is dependent on local rainfall and in other cases these two variables are completely independent. In any case, accurate analysis of expected performance of a proposed storage treatment system requires continuous hydrologic simulation studies.

The approximate performance of an urban runoff storage treatment system can, however, be estimated by application of probability theory with certain simplifying assumptions. Such estimates were developed for the three design storm criteria utilized in this study and are reported in Table 4.2. These estimates are based on an average of 104 storms per year and a treatment rate such that the design volume is treated in 3.5 days (i.e., $TR = DVS/3.5$). Additionally, it is assumed that runoff is directly proportional to rainfall for all storm events. The values of 104 storms per year, and 3.5 days to treat the design volume, are average values obtained from the ten site studies.

Inspection of Table 4.2 reveals several important points concerning the selected storage treatment systems. First of all, it can be seen from columns 2, 3, and 4, that overflow events result from two separate causes: (1) storm magnitude; and (2) storm sequence. Overflow events resulting from storm magnitude are caused by the occurrence of a storm greater than the design storm. Additional overflow events may result when a storm less than design storm magnitude occurs while the storage facility is partially full. This type of overflow is due to storm sequence, and its frequency of occurrence can be estimated by methods based on conditional probability. The greatest number of overflow events will result from the occurrence of a storm greater than the

TABLE 4.2

ESTIMATED PERFORMANCE OF SELECTED STORAGE TREATMENT SYSTEMS

Design Storm Percentile (1)	Expected Value of Overflow Events per Year Due to Storm Magnitude[4] (2)	Expected Value of Overflow Events per Year Due to Storm Sequence[5] (3)	Total Expected Value of Overflow Events per Year (4)	Percent of Annual Runoff Treated (5)	Expected Frequency of Wet Weather W.Q. Criteria Exceedence in Events per Year[6] (6)	Probable Criteria Exceeded (7)
80[1]	20.8	2.7	23.5	77	1 to 5	Suspended Solids
90[2]	10.4	1.2	11.6	88	1 to 3	Dissolved Oxygen
98[3]	2.1	0.1	2.2	97	0.2 to 1.0 up to 2.2	Dissolved Oxygen Bacteria

[1] Applies to treatment of stormwater runoff only.
[2] Applies to treatment of combined sewer overflow to meet aesthetics and fish and wildlife criteria.
[3] Applies to treatment of combined sewer overflow to meet recreation criteria.
[4] Based on 104 storms per year.
[5] Based on 104 storms per year and 3.5 days to treat design storm runoff volume.
[6] Exact values will depend on receiving streamflow characteristics but should fall within stated range.

design storm (column 2, Table 4.2); however, a significant number of additional overflow events occur as a result of storm sequence (column 3, Table 4.2).

It is noted that the values reported in column 3 are a function of the treatment rate criteria and will become smaller as treatment rate is increased. If the design treatment rate is increased to the point where all runoff is treated within one day of the beginning of the storm, then the values reported in column 3 would approach zero. However, the values reported in column 2, which account for the major portion of the overflow events, would remain unchanged. Thus, substantial increases in the design treatment rate will not result in greatly improved system performance as measured by number of overflow events per year.

Column 5 of Table 4.2 shows the estimated percentage of annual runoff which will be captured and treated by the proposed facilities. The remaining fraction of runoff will continue to be discharged directly to the receiving water untreated.

Column 6 contains the estimated range of frequency of exceedence of wet weather water quality criteria and column 7 indicates which of the water quality standards are likely to be exceeded, for each set of facilities design criteria. Exact values for parameters reported in these two columns will be dependent upon receiving water characteristics which vary significantly, but should in general fall within the estimated range.

4.9 POLLUTION LOADING FROM DESIGN STORM

In order to determine the receiving water impact from nonpoint source loadings, it is necessary to estimate average runoff rates and pollution loading rates resulting from the design storm. Average runoff rates were computed by one of two methods, depending upon the relative value of the design storm duration and the approximate time of concentration of the urban catchment area. If the time of concentration is less than the storm duration, then the mean runoff rate was computed as follows:

$$Q = \frac{DS \times C \times DA \times 640}{(SD + 1.67\ TC)} \qquad (4.5)$$

Where:

Q = Average runoff rate for the urban watershed in cfs
DS = Design rainfall depth in inches
C = Runoff coefficient

DA = Drainage area of urban watershed in acres
SD = Duration of design storm in hours
TC = Time of concentration of urban watershed in hours

If the time of concentration is greater than the duration of the design storm, then the mean runoff rate was computed by the following equation:

$$Q = \frac{DS \times C \times DA \times 484}{(SD + 1.2\ TC)} \qquad (4.6)$$

Where all terms are defined above.

The above equations are based on the Soil Conservation Service triangular runoff hydrograph technique[2] and should result in reasonable estimates of the average rates of runoff from individual urban watersheds.

Pollution loads expressed as pounds per day of carbonaceous BOD and nitrogenous BOD were estimated by various methods. If site specific data were available, then mean observed concentrations of pollutants were computed and used in conjunction with the estimated mean runoff rates to compute loading rates. If observed concentrations were not available, then reasonable values were assigned based on typical values reported in the literature.[3,4,5] The waste loading rates resulting from the design storm, as estimated for each source for each of the 10 study sites, are reported in Appendix A. Constituents reported include five day BOD (BOD_5), ultimate oxygen demand (UOD) and suspended solids (SS).

4.10 RECEIVING WATER IMPACT ANALYSIS

Receiving water dissolved oxygen response for each study site was estimated based on the waste source flows and loading rates resulting from the 80th percentile storm, and on the conceptual urban area receiving water system as illustrated in Figure 4.1.

The steady state water quality model (AUTOSS) developed as part of the "Auto-Qual Modeling System,"[6,7] was used to compute the DO sag curve resulting from the waste inputs. This computer program utilizes the Eulerian mass transfer equation to represent dispersion and decay of pollutants. AUTOSS will account for nitrogenous oxygen demand, as well as carbonaceous oxygen demand, and can be applied to freshwater streams and estuary systems.

The AUTOSS computer program is a plug flow or steady state model and, therefore, represents the dissolved oxygen budget within the discrete unit of water generated by the urban system. Dissolved oxygen transfers, including organic decay and atmospheric reaeration, are included. These computations result in knowledge of the dissolved oxygen concentration as a function of time within the discrete plug flow of interest. Inspection of the resulting DO sag curve will reveal the minimum or critical DO concentration occurring in the receiving water.

Decay rates utilized in the computations were varied with the type of waste source, as summarized below:

Waste Source	Decay Rate Day^{-1} (base e)
1. Carbonaceous material	
Wastewater effluent	0.23
Combined sewer overflow	0.40
Urban runoff (storm water)	0.16
2. Nitrogenous material (all)	0.10

Reaeration rates were estimated by either the O'Connor Dobbin's equation, which is built into the computer program[6] or by the Tsivoglou equation developed in 1972.[8] In the case of the Delaware estuary previously reported values of the reaeration coefficient were utilized.[9]

The base flow condition of the receiving water is also an important parameter which is considered in the dissolved oxygen budget computations. Streamflow is the sum total result of the rainfall-runoff process and is, therefore, probabilistic. At any given time, the flow rate observed at a stream cross-section can vary from no flow, under extreme drought conditions, to several thousand cfs, under extreme flood conditions. Like other hydrologic variables, streamflow is random and, therefore, cannot be predicted with certainty. Furthermore, it is not the streamflow alone which is of interest, but a combination of streamflow and residual dissolved oxygen, which is a function of water temperature and background oxygen demanding materials.

It is convenient to address base receiving water conditions from the concept of oxygen resources. Oxygen resources of a flowing body of water can be defined as the rate of dissolved oxygen flow observed at a given point along the stream. In this case, the point of interest is just upstream of the urban area being considered. The rate of dissolved oxygen flow is simply the product of the streamflow times the dissolved oxygen concentration. This computation will yield a flow rate of oxygen in appropriate units (for example, pounds of O_2 per day) which is a measure of the oxygen resources of the receiving water.

The criteria used in the site studies to define receiving water conditions were based on average monthly oxygen resource, which is defined as the product of average monthly streamflow times the corresponding average dissolved oxygen content. This value was computed for each month of the year and the lowest value was utilized in the receiving water analysis. Thus, the low oxygen resource month based on mean monthly flows was utilized in the water quality impact analysis. In general, this condition occurs in late summer or ealy fall when streamflow are low and water temperatures are high. This parameter was evaluated at each site by analysis of observed streamflow records.

The above receiving water low flow is considerably larger than the 7-day, 10-year low flow usually utilized in the impact analysis of continuous point source waste discharge. The new criteria was chosen because the conditional probability of observing one or more design storms during the 7-day, 10-year low flow period is extremely small. For example, the frequency of occurrence of the 80th percentile storm concurrently with the 7-day, 10-year low flow is once every 30 years. When the 90th percentile storm is considered, the expected return period increases to 55 years; and when the 98th percentile storm is considered, the return period becomes 255 years. All of the above combinations represent rare events.

The 80th percentile storm and the low flow criteria discussed above were utilized in each of the ten receiving water impact analyses. The primary purpose of each site impact analysis was to determine receiving water response for a known set of hydrologic and urban area conditions and not necessarily to determine critical conditions for each of the ten selected sites. Section 6 of this report discusses in detail the analysis of the data generated by the receiving water impact computations and the general relationship developed from these data. This relationship can then be applied to any desired combination of design rainfall and receiving water flow to determine treatment needs for the selected conditions.

Receiving water impact analyses, as discussed herein, were performed for all study sites except for the San Francisco Bay Area. In the case of the Bay Area, extensive water quality impact analyses have been completed for the California State Water Resources Board and the San Francisco Bay Region Water Quality Control Board. These studies were extensive and detailed and have been published.[10] Information contained within the published report included estimates of the assimilative capacity of selected portions of the bay based on dynamic water quality analysis performed by Water Resources Engineers, Inc.[10] These assimilative capacity determinations included the development of curves relating residual minimum dissolved oxygen to ultimate oxygen demand. Thus the procedure utilized in the present study was to estimate the oxygen demand resulting from design storm runoff and point discharges and to utilize the previously developed DO versus loading curves to obtain an estimate of the residual dissolved oxygen.

4.11 DETERMINATION OF REQUIRED TREATMENT LEVEL

Required level of treatment for storm water and combined sewer overflow is a function of the percentage of organic load (UOD) which must be removed in order to meet the minimum standard of 5.0 mg/l of residual dissolved oxygen. If the receiving water analysis indicates that the minimum dissolved oxygen level is 5.0 mg/l or greater, then no treatment will be required. If the dissolved oxygen level is less than 5.0 mg/l, then removal of a portion of the oxygen demanding material will be necessary.

In those cases where the impact analysis identified a dissolved oxygen level less than 5.0 mg/l for the design storm condition, an additional DO response curve for point source waste loads only was computed. Both curves, representing design storm and dry weather flow conditions, were then plotted on a common axis. Inspection of these curves clearly establishes the extent of the DO depression which is due to the nonpoint waste loads. Once the magnitude of the DO depression due to nonpoint waste loads is known, then the percentage removal required to achieve a minimum residual of 5.0 mg/l can be easily computed.

In addition to the DO response of the receiving water, suspended solids production and concentrations were estimated. In certain cases, the removal of suspended solids controlled the removal efficiency required to meet receiving water quality standards. Generally, suspended solids problems are associated with stormwater runoff and dissolved oxygen and bacteria problems are associated with combined sewer overflow.

Knowing the required removal, an appropriate level of treatment is selected. The treatment levels utilized in this study along with a listing of processes included in each level are presented in Table 3.1.

Section 5

DESCRIPTION OF STUDY SITES

The sites selected for receiving water impact evaluation represent a wide range of conditions, from small, low density urban areas served by separate sewer systems to large, high density cities served by combined sewer systems. Also, receiving waters considered ranged from free-flowing mountain streams to sluggish tidal estuaries. The selection of such a wide range of urban area/receiving water conditions was a stated objective of the study as discussed in the previous section.

The following is a brief description of each of the selected study sites, the associated receiving waters and the impact analysis. Details of each site, including demographic data, receiving water characteristics, waste loading data, and rainfall data, are presented in Appendix A. Also presented in this appendix is a conceptual sketch of each urban area/receiving water system and the DO response curve, for the receiving water, resulting from storm generated waste load inputs.

5.1 ATLANTA

The Atlanta urban area is located along a ridge separating three distinct river systems, including the Chattahoochee River, the Flint River, and the South River. The study area is that portion of the Atlanta urban area tributary to the Chattahoochee River and includes all of the urbanized Peachtree Creek watershed. Approximately six percent of the study area is served by combined sewers, the remainder is either drained naturally or served by storm sewers.

The receiving water is the Chattahoochee River beginning just upstream of its confluence with Peachtree Creek and extending approximately 80 miles downstream. The first 20 miles of this distance is urban area. Waste inputs include urban runoff, combined sewer overflow, and municipal wastewater treatment plant effluent.

Receiving water impact analysis indicates that no treatment of combined sewer overflow or stormwater discharge would be required to maintain minimum dissolved oxygen for the selected storm event.

Major site specific references utilized to define urban area and receiving water characteristics of the Atlanta study site include a recent report dealing with nonpoint source pollution evaluation[11] and water quality data published by the state of Georgia.[12]

5.2 DES MOINES

The city of Des Moines is located in central Iowa at the confluence of the Des Moines and Raccoon rivers. The study area includes all of the city of Des Moines. Approximately seven percent of the Des Moines urban area is served by combined sewers with the remainder served by separate sewer systems.

The receiving water is the Des Moines River beginning at the upstream end of the urban area and extending approximately 45 miles downstream. Waste inputs include urban runoff, combined sewer overflows and municipal wastewater treatment plant effluent.

Receiving water impact analysis indicates a DO depression within the receiving water to a value of 4.95 mg/l, which is less than the minimum criteria of 5.0 mg/l. An overall removal of approximately two percent of the UOD due to urban runoff and combined sewer overflow would be required to meet the minimum wet weather DO criteria for the selected storm runoff event.

Site specific data for the Des Moines urban area and the Des Moines River were obtained from a combined sewer overflow abatement plan developed in 1974,[13] and from water quality publications of the state of Iowa.[14,15,16]

5.3 DURHAM

The city of Durham is located on a ridge in east-central North Carolina. Surface waters drain both to the north and to the south through a system of headwater creeks. The selected study area consists of that portion of the city of Durham and adjacent areas tributary to Third Fork Creek upstream of the Third Fork Creek wastewater treatment plant. The total tributary area is approximately 8.7 square miles at this point. The study area is served completely by separate wastewater collection systems.

The receiving water is Third Fork Creek beginning within the urban area and extending approximately 28 miles downstream. Waste input includes urban, suburban and rural runoff as well as wastewater treatment plant effluent.

Receiving water impact analysis indicates that no treatment of stormwater discharge would be required to maintain minimum wet weather dissolved oxygen criteria for the design storm event. These results are in substantial agreement with a previous impact analysis of this watershed reported by Colston.[17] In this study, the impact of several storms, including a "small storm" (0.10-inch of rainfall) was analyzed. The small storm required no treatment to meet the 5.0 mg/l criteria, whereas the larger storms (1.0 to 3.3 inches of rainfall) would require some treatment. The present analysis indicates that a rainfall event of 0.69 inch will result in a minimum DO level of 5.8 mg/l, and thus does not require treatment to meet wet weather criteria. However, removal of approximately 34 percent of urban and suburban area suspended solids would be required to meet wet weather suspended solids criteria.

Major site specific references included the previously cited Colston report,[17] the state of North Carolina Water Quality Management Plan,[18] and computer printouts of river basin water quality data, for Third Fork Creek, supplied by the Division of Environmental Management of the North Carolina Department of Natural and Economic Resources.

5.4 LUBBOCK

Lubbock is located on the "high plains" of west Texas near Yellow House Canyon. The study site includes the entire Lubbock urban area which is tributary to the intermittent Brazos River. This stream flows through Yellow House Canyon in the vicinity of Lubbock. There are no combined sewer systems within the study area and all wastewater effluent are reclaimed by means of a land spreading (spray irrigation) system.

The receiving water is the North Fork of the Double Mountain Fork of the Brazos River (Yellow House Canyon) which is normally dry. Surface runoff from Lubbock is presently routed through a series of overflowing lakes in Yellow House Canyon in an effort to reclaim this water. For the purposes of this study, the existing retention lakes were ignored and a free-flowing river system was assumed for analysis. This analysis allows a hypothetical receiving water which receives waste loads from an urban area with Lubbock's runoff quantity and quality characteristics to be compared with the receiving water impact analyses of other study sites. Because there are no combined sewers within the study area, and because all wastewater effluent are reclaimed by spray irrigation, the only waste input to the receiving water is urban runoff.

Receiving water impact analyses indicate that no treatment of urban runoff would be required to maintain minimum wet weather dissolved oxygen criteria for the selected storm event. Suspended solids removal of approximately 26 percent will, however, be required to meet wet weather receiving water criteria.

Major site specific references include reports on urban runoff for the Lubbock area prepared by Texas Tech University Water Resources Center,[19,20,21] and the Water Quality Management Plan for the Brazos Basin.[22]

5.5 MILWAUKEE

The Milwaukee study area consists of all urban area tributary to the Milwaukee River south of the Milwaukee-Ozaukee County line. Urban areas tributary to the Menomonee and Kinnickinnic rivers are not included in this analysis. Approximately 17 percent of the study area is served by combined sewers. The combined sewer systems are located in the densely developed downtown area and consequently serve approximately 61 percent of the resident population. There are approximately 62 discrete combined sewer overflow points discharging untreated wastewater to the lower Milwaukee River. The remaining urban area upstream of the combined sewer systems is served by separate sewer systems and thus discharge stormwater runoff only to the Milwaukee River.

The receiving water is the Milwaukee River beginning at the Milwaukee-Ozaukee County line and extending to the south into Milwaukee Bay and ultimately into Lake Michigan. Waste sources include suburban stormwater runoff, urban stormwater runoff, combined sewer overflow and treated wastewater effluent from the Jones Island wastewater treatment plant which discharges into Milwaukee Bay. As previously stated, flows from the Menomonee and Kinnickinnic rivers were not included in the analysis. These rivers do, however, discharge to Milwaukee Bay and will provide dilution during base flow conditions for the Jones Island plant effluent. Therefore, for the purpose of this impact analysis, only one-half of the Jones Island effluent was considered tributary to Milwaukee River flows.

Receiving water impact analyses indicate that a minimum DO residual of 4.3 mg/l will occur in Milwaukee Bay, which is considerably less than the minimum criteria of 5.0 mg/l. Removal of approximately 55 percent of the organic load from stormwater and combined sewer overflow would be required to meet the wet weather criteria. If all the required removal were obtained by treatment of combined sewer overflow only, then this waste source would need to be treated to approximately 76 percent reduction in UOD. This level of treatment for combined sewer overflow only is more cost-effective than treatment of both combined sewer overflow and stormwater runoff to a lesser degree of organic removal.

Site specific data for the Milwaukee River and the city of Milwaukee, as well as water quality and hydrologic information were obtained primarily from a comprehensive plan for the Milwaukee River watershed prepared by the Southeastern Wisconsin Regional Planning Commission.[23]

5.6 PHILADELPHIA

The city of Philadelphia is located in eastern Pennsylvania at the confluence of the Delaware and Schuylkill rivers. The entire urban area, consisting of some 200 square miles, is considered in this study. The city is heavily industrialized and contains many industrial waste sources as well as numerous municipal wastewater treatment plants. The central portion of the city, covering approximately 35 square miles, is served by combined sewers.

The receiving water is the Delaware River/estuary from Trenton, New Jersey on the upstream end to a point approximately 40 miles downstream from the Philadelphia urban complex. This portion of the Delaware River is a tidal estuary and has been studied previously by Thomann,[9] and Betz Environmental Engineers, Inc.[24] Most of the physical data used to describe the Delaware estuary, including hydraulic and dispersion data were taken from the Thomann study and much of the point source waste load data was taken from the Betz study. Additional data were obtained from the city of Philadelphia Water Department[25] and recent unpublished waste load data were obtained from the Delaware River Basin Commission. Data concerning ultimate point source waste load allocations (Table A-7, Appendix A) were obtained from the EPA regional office in Philadelphia. All types of waste sources including stormwater runoff, combined sewer overflow, wastewater treatment plant effluent, and industrial waste discharges are present within the limits of the study area.

Four dissolved oxygen profiles representing different waste loadings were computed for the Delaware estuary. The conditions considered were: (1) existing point sources only; (2) existing point sources plus urban runoff and combined sewer overflow; (3) allocated point source waste loads only; and (4) allocated point source waste loads plus urban runoff and combined sewer overflow. The computed DO profiles are presented in Appendix A (Figures A-12 and A-13). The results of these computations indicate that for all four waste loading conditions, a minimum DO standard of 5.0 mg/l will not be met. Furthermore, for the condition of existing point source waste loads plus storm runoff, the DO level in the estuary will fall to zero. This analysis indicates that treatment of all stormwater runoff and combined sewer overflow to 100 percent organic load removal will not meet wet weather water quality criteria.

Thomann[9] reported observed minimum values of DO in the Delaware estuary of between 3.0 mg/l and 0.0 mg/l with a mean value of approximately 1.0 mg/l. These observations were made during the summer of 1964. The computed DO curves for wet and dry weather conditions, and existing point source loads envelop these observed values. Such agreement with actual field observations tends to support the validity of the impact analysis.

The Philadelphia study site has the most severe receiving water quality problems of any of the ten selected sites. Theoretically, 157 percent of all nonpoint UOD would have to be removed to meet the 5.0 mg/l criteria for existing point source waste loads, and approximately 123 percent of the nonpoint UOD would have to be removed to meet the criteria with allocated point source waste loads. Obviously, additional wastewater, stormwater and combined sewer overflow treatment facilities will be required to meet water quality objectives.

5.7 PORTLAND

The city of Portland is located at the confluence of the Columbia and Willamette rivers in northwestern Oregon. The entire city is tributary to either the Columbia or the Willamette, with the large majority tributary to the Willamette. Approximately two percent of the Portland urban area is served by combined sewers.

2

The receiving water is the Columbia River beginning at its confluence with the Willamette River and extending approximately 30 miles downstream. Since all waste sources are tributary to the Willamette River, in its extreme lower reaches, these waste loads were summed, added to the base flow of the Willamette, and input for computer analysis as a single waste source entering the Columbia River. This procedure ignores a small amount of biological activity and reaeration which may take place in the lower reach of the Willamette River; however, the error introduced by this simplification should be negligible. Waste sources include urban runoff, combined sewer overflow and municipal wastewater treatment plant effluent.

Receiving water impact analysis indicates that no treatment of urban runoff or combined sewer overflow would be required to maintain minimum DO or suspended solids criteria for the selected storm event.

The major source of site specific water quality data was a report prepared by the State of Oregon.[26]

5.8 ROANOKE

The city of Roanoke is located in western Virginia at the confluence of the Roanoke River and Tinker Creek. The entire urban area is within the limits of the Roanoke River drainage basin and all urban area is considered in this study. Roanoke is served entirely by a separate wastewater collection system. The receiving water is the Roanoke River beginning at the upstream limits of the urban area and extending approximately 25 miles downstream. Waste sources include urban runoff and treated municipal wastewater effluent.

From the receiving water impact analysis, it was determined that no treatment of stormwater runoff would be necessary to meet minimum wet weather DO or SS criteria within the receiving stream under the selected storm conditions.

Site specific data were obtained from two previous engineering reports[27,28] and from a water quality inventory prepared by the State of Virginia.[29]

5.9 SAN FRANCISCO

The San Francisco Bay system consists of two main arms, San Pablo Bay located to the north of Golden Gate and San Francisco Bay located to the south of Golden Gate. This study is concerned with the San Francisco Bay area located south of the Golden Gate. The area tributary to San Francisco Bay totals approximately 1,850 square miles, of which approximately 70 percent is rural and 30 percent is urban. The urban areas are located adjacent to the Bay and include, among others, the cities of San Francisco, San Mateo, Redwood City, Palo Alto, San Jose, Union City, Hayward, San Leandro, and Oakland. The combined 1975 population of these bay area cities and adjacent lands tributary to the bay was approximately 3,422,000 persons.

The San Francisco Bay area is by far the largest site selected for this study. It was necessary to include all bay area communities within the study since they form a contiguous urban complex and all discharge wastes to the same receiving water. Waste sources include approximately 45 square miles of combined sewered area located entirely within the city of San Francisco and 2.5 square miles of combined sewered area located in the city of Oakland. Of the remaining urbanized area, approximately 98 square miles are industrialized and 410 square miles are either commercial or residential. All of these areas are served by separate wastewater collection systems.

DO budget computations were not carried out for the San Francisco Bay area for two reasons. First the San Francisco Bay system is a huge estuary up to 12 miles wide which receives very little freshwater inflow during the dry season. Because of its geometry and because the principal mechanism of water exchange is tidal flushing, the one dimensional estuary model which performed well in the case of the Delaware estuary would yield conceptually inaccurate results if applied to San Francisco Bay. Secondly, the bay system has been studied extensively by others[10] and the DO response to waste loadings has been defined. This determination was made utilizing a two-dimensional dynamic water quality simulation of the bay or selected portions of the bay.[10] The procedure used in the present study was to estimate waste loadings resulting from the selected storm and to apply these waste loadings to previously developed relationships between DO residual in mg/l and UOD in lb/day. In this manner, the impact of nonpoint source loads on San Francisco Bay was estimated.

The previous study[10] established that the vast northern portion of San Francisco Bay is well flushed by tides inflowing and outflowing through the Golden Gate and that dissolved oxygen conditions in this portion of the bay are quite good even with the discharge of combined sewer overflow. Bacteriological contamination has, however, been identified as a problem in this portion of the Bay. The southern portion of the bay, known as South Bay, and defined as that portion of San Francisco Bay south of Alameda Creek, experiences severe DO problems.

South Bay is located approximately 30 miles from the Golden Gate. It experiences very poor tidal flushing, is shallow, and receives little freshwater inflow during the dry season. South Bay is also surrounded by an urban complex supporting approximately 1,461,000 persons. The assimilative capacity of the South Bay has been estimated to be 140,000 lb/day of UOD if a DO residual of 6.0 mg/l is maintained (Reference 10, page 15-78). Allowable UOD increases to 308,000 lb/day if a DO residual of 5.0 mg/l is maintained. Total UOD loading for the selected storm is estimated to be 400,340 lb/day, which will result in a minimum DO level of approximately 4.4 mg/l. This analysis indicates that removal of approximately 30 percent of all organic loads from stormwater runoff tributary to the South Bay would be required to meet a minimum wet weather DO criteria of 5.0 mg/l within the South Bay. Treatment of stormwater runoff and combined sewer overflow discharged to the main body of San Francisco Bay would not be required to meet DO criteria.

In addition to previously cited sources, site specific data were obtained from a previous needs study[30,31] and an engineering report on treatment of combined sewer overflow for the city of San Francisco.[32]

5.10 TULSA

The city of Tulsa is located in eastern Oklahoma on the Arkansas River. The entire urban area of the city is tributary to the Arkansas River and, therefore, the whole city is considered in this study. Tulsa is served entirely by separate wastewater collection systems.

The receiving water is the Arkansas River beginning at the upstream end of the urban area and extending approximately 45 miles downstream. Waste sources include urban runoff and wastewater treatment plant effluent.

Receiving water impact analysis indicates that treatment of urban runoff is not necessary to meet minimum wet weather DO or SS criteria in the Arkansas River.

Site specific data for the Tulsa area were obtained from a previous study of urban stormwater quality,[33] a water quality management plan for the Arkansas Basin,[34] and a regional environmental pollution study of the Tulsa region.[35]

Section 6

ANALYSIS OF RAINFALL, WASTE LOADING AND TREATMENT DATA

The ten site investigations resulted in the development of a considerable volume of site specific data related to hydrology, waste loadings, and required stormwater and combined sewer overflow treatment. It is the purpose of this section to report and analyze these data, and to develop appropriate conclusions and generalizations which can be applied nationwide for the purpose of estimating national needs.

6.1 ANALYSIS OF RAINFALL DATA

Five years of continuous hourly rainfall data were obtained and analyzed for each of the ten study sites in order to develop estimates of design storm parameters. These parameters were then used in the impact analysis and in the sizing of storage and treatment facilities. Once storage volumes, treatment rates and required treatment levels are known, construction and operation and maintenance costs for these facilities can be estimated by application of the facilities costs equations presented in Section 3.

The following is an analysis of the design storm and facilities design parameters obtained from the five years of hourly rainfall data at each study site. The objective of this analysis is to identify appropriate simplifications or relationships among the rainfall variables and to establish a procedure which can be used in the national needs projection to estimate design storm and facilities design parameters utilizing only easily obtainable climatological data summaries. Such data summaries are available for each of the 320 urbanized areas considered in the national needs projection.

Table 6.1 presents a summary of rainfall data obtained from analysis of hourly rainfall and from available climatological summaries. Data reported in Column 2, long-term mean annual rainfall, and Column 5, number of days with rain per year, were obtained from the climatological summaries; whereas, data reported in Column 3, 5-year mean annual rainfall, Column 4, number of storms per year, Column 6, mean depth, Column 7, design duration, and Column 8, mean time between storms, were obtained from the analysis of hourly observed rainfall records for each study site.

6.1.1 Mean Annual Rainfall

Long-term mean annual rainfall varies from 18 inches in Lubbock, Texas, to over 48 inches in Atlanta, Georgia, and is one of the most

TABLE 6.1
SUMMARY OF RAINFALL DATA

Site (1)	Long Term Mean Annual Rainfall (inches) (2)	5-Year Mean Annual Rainfall (inches) (3)	Number of Storms per Year (4)	Number of Days with Rain per Year (5)	Mean[1] Rainfall Depth MRF (in.) (6)	Design[2] Duration (hours) (7)	Mean Time[3] Between Storms (hours) (8)	Symbol (9)
Atlanta	48.34	51.75	115	115	0.45	10.3	57.37	A
Des Moines	30.88	38.05	119	103	0.32	12.65	67.50	I
Durham	42.50	44.11	103	114	0.43	9.63	76.50	D
Lubbock	18.00	19.98	57	60	0.35	11.35	101.80	L
Milwaukee	29.07	31.68	123	123	0.26	7.76	70.13	M
Philadelphia	39.93	48.80	113	115	0.43	16.46	74.24	P
Portland	37.61	40.49	148	154	0.27	9.57	55.80	O
Roanoke	41.23	49.19	117	120	0.42	11.76	60.65	R
San Francisco	20.66	19.66	61	67	0.32	9.53	69.11	S
Tulsa	37.08	49.97	82	90	0.61	20.20	97.35	T

Mean Duration = 12 hours
Mean Time Between Storms = 73 hours
Mean Number of Storms per Year = 104

[1] 80 percent storm depth = 1.61 x MRF
[2] Mean duration of 80 percent storm
[3] Mean time between storms for low flow period

significant of all rainfall parameters. In addition to geographic variations, annual rainfall can be quite variable from one year to the next. Thus, a certain degree of statistical risk is involved when selecting a random 5-year period of record for analysis. In order to determine if the sample periods selected for analysis were representative, the long-term mean annual rainfall for each city was compared to the mean annual rainfall obtained from the selected 5-year sample. This comparison is shown in Figure 6.1, which is a scattergram of long-term mean annual rainfall versus the 5-year mean annual rainfall. On the average, the sample period received 14 percent more rainfall than the long-term period. This small bias will, however, have no effect on the national needs projection, since long-term values were utilized in the national cost computations.

6.1.2 Annual Number of Storms

A storm event, as defined for the ten site studies, is a period of rainfall separated from the preceding period of rainfall and from the succeeding period of rainfall by dry periods of at least six hours. Thus, the procedure utilized to determine the number of storms per year, the duration of each storm, and the time between storms, involved detailed analysis of the 5-year period of record at each site. The number of storms per year, as defined above, is not a readily available climatological parameter. However, the number of days with rain per year (Column 5, Table 6.1) is a climatological parameter which is known for all urbanized areas in the nation. For this reason, the relationship between number of storms per year and number of days with rain per year was investigated. This investigation revealed that a strong, positive correlation between these parameters does in fact exist, as illustrated on Figure 6.2. Inspection of Figure 6.2 indicates that the relationship between these variables is linear and that the line of best fit, as determined by regression analysis, is given by the following equation:

$$MNS = 1.0026\,(ADR) - 2.58 \qquad (6.1)$$

Where:

MNS = Mean number of rain storms per year
ADR = Mean number of days with rain per year

Knowing the number of days with rain per year for a given city, the number of storms per year can be estimated by application of the above equation.

6.1.3 Time Between and Duration of Storms

Possible statistical relationships between the time between and duration of storms for critical period (low flow) conditions, and

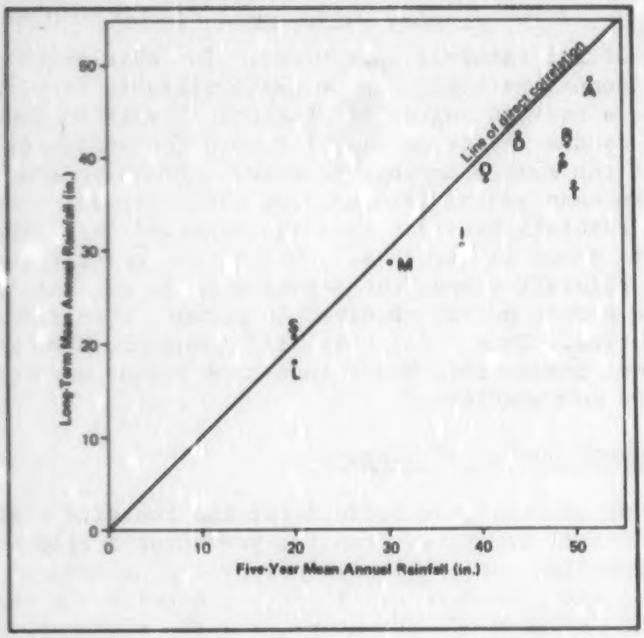

FIGURE 6.1. LONG-TERM MEAN ANNUAL RAINFALL VS. FIVE-YEAR MEAN ANNUAL RAINFALL.

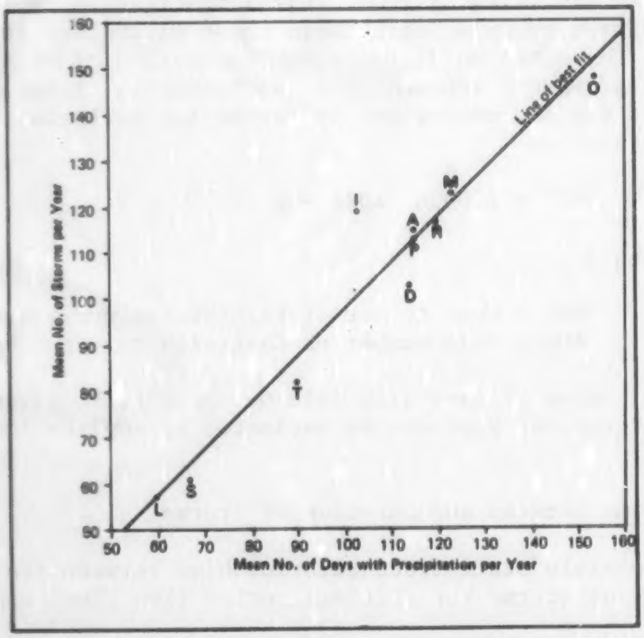

FIGURE 6.2. NUMBER OF STORMS PER YEAR VS. NUMBER OF DAYS WITH PRECIPITATION PER YEAR.

other climatological parameters, were also investigated. Possibilities considered included linear relationships between the following variables:

1. Number of storms per year and mean time between storms;
2. Mean annual rainfall and mean time between storms;
3. Design duration and mean time between storms;
4. Design duration and design depth.

Each of these data pairs were plotted in a manner similar to that shown on Figure 6.2. However, in each case, strong linear correlations were not indicated.

The time between storms and duration of storms for critical period conditions were also considered from a geographical standpoint. However, variations in these variables were not readily explained by this approach either.

Because computed values of the design storm duration and the mean time between storms for critical period conditions could not be related to other rainfall parameters, or explained by geographic considerations, it was assumed that the sum of these parameters could be estimated as follows:

$$(TBS + SD) = 365/MNS \tag{6.2}$$

Where:

(TBS + SD) = The sum of the mean time between storms plus the mean duration of storms, in days

MNS = Mean number of storms per year

The above equation will yield a good estimate of the overall annual average sum of the time between and duration of storms at a given site, but will not necessarily represent conditions prevailing during critical receiving water conditions.

6.2 GENERALIZED DESIGN STORM, STORAGE AND FLOW PARAMETERS FOR NATIONAL NEEDS PROJECTION

One of the stated objectives of the rainfall data analysis was to establish a procedure which can be used in the national needs projection to estimate design storm and facilities design parameters. This procedure is outlined in this subsection.

Two site specific climatological data parameters are available for each urban area. These are: (1) mean annual rainfall (ARF), and

(2) mean number of days with rain (ADR). Given site specific values for these parameters, the procedure used to estimate other design parameters is given five steps, as follows:

Step 1 Estimate mean number of rain storms per year (MNS)
MNS = 1.0026 (ADR) - 2.58 (6.3)

Step 2 Compute mean rainfall depth per storm (MRF)
MRF = ARF/MNS (6.4)

Step 3 Compute design depth for x percentile storm
DS = K_x MRF (6.5)

Step 4 Compute design volume (DVS)
DVS = DS x C x DA x 0.02715
(mg) (in.) (acres) (6.6)

Step 5 Compute design flow rate for treatment facility (TR)

TR = DVS/(365/MNS)
(mgd) (days) (6.7)

One additional hydrologic variable is required for the receiving water impact analysis. This variable is the mean runoff rate from the urban area, and is utilized in the evaluation of required treatment for each urbanized area in the nation. This evaluation is discussed in Section 6.3 of this report.

The mean runoff rate resulting from the 80th percentile storm was computed for each of the ten study sites, based in part on estimates of the hydraulic time of concentration of the urbanized area tributary to the receiving water. The times of concentration of all urbanized areas in the nation are not known, nor are they readily estimated. Therefore, the procedure used in the national projection computations was to assume that all excess surface water, resulting from the design storm, would run off in a period equal to the mean storm duration (12 hours). The mean flow rate in cfs is then equal to 3.09 X DVS, where the volume (DVS) is expressed in million gallons. This procedure will tend to overpredict by a small amount the mean rate of runoff, since some water will be held in temporary watershed storage and will runoff after rainfall has ceased.

6.3 ESTIMATING REQUIRED ORGANIC REMOVAL

The ten site studies identified four cities, Des Moines, San Francisco Bay Area, Milwaukee, and Philadelphia, as requiring some treatment of combined sewer overflows and/or stormwater runoff to meet the selected wet weather dissolved oxygen criteria of 5.0 mg/l in the receiving water for selected storm and low flow conditions. It is the purpose of the analysis presented here to identify what urban area and receiving water parameters are important in establishing whether or not a given city will require treatment of these sources of pollution. The objective of this analysis is to develop, from the site study data, a relationship between urban area characteristics and required nonpoint source treatment which can be applied to all cities for the national needs computation.

A summary of the site study data and resulting treatment requirements is presented in Table 6.2. It is noted that the BOD_5 loading rate (Column 5, Table 6.2) can generally be estimated somewhat more easily and more accurately than can the UOD loading rate. Therefore, since this parameter accounts for all pollution sources, and can be estimated for all urbanized areas, it should appear in generalized relationships developed, from this data. Also, the total flow downstream of the urban area (Column 3, Table 6.3) is a function of all hydrologic variables operating on the urban area, including base flow and storm induced flows, and thus should appear in the generalization. Considering the above, an attempt was made to relate the BOD_5 per unit of streamflow (BOD/Q_{DS}) to the required organic removal. BOD per unit of flow is a measure of pollutant concentration and should logically be related to the organic removal required to meet desired stream oxygen levels. However, no relationship was indicated.

Upon further consideration, it was reasoned that an important parameter, the natural assimilative capacity of the receiving water, is not accounted for when only pollutant concentration is considered. Furthermore, a numerical measure of receiving water assimilative capacity is available for all study sites. This measure is the reaeration coefficient K_2 (Column 4, Table 6.1) of the receiving water. This coefficient is a measure of the ability of a receiving stream's capacity to accept oxygen demanding materials. The higher the value, the more pollutants a given receiving water can accept before DO problems develop. Thus, required organic removal should be inversely proportional to the value of the reaeration coefficient, K_2.

Based on the above reasoning, a "lumped quality parameter" was defined as the total BOD_5 load in pounds per day divided by the product of the total streamflow and the reaeration coefficient. That is:

$$RF = \frac{BOD}{Q_{DS}\ K_2} \qquad (6.8)$$

Where:

RF = Urban area quality parameter (reduction factor)

TABLE 6.2

SUMMARY OF SITE STUDY BOD TREATMENT REQUIREMENTS

Study Site (1)	Base Flow, cfs (2)	Total Flow, cfs (3)	K_2 day^{-1} (4)	BOD_5 #/day (5)	UOD #/day (6)	Overall BOD Removal Req. (7)	$\frac{BOD_5}{Q_{total} K_2}$ (8)
Atlanta	2,499	4,708	1.5	109,819	359,369	0	16
Des Moines	2,186	3,346	1.9	472,100	1,010,180	2%	74
Durham	6.8	94.4	2.5	8,636	25,011	0	37
Lubbock	0	219	7.1	17,390	31,580	0	11
Milwaukee	170	467	1.1	67,000	214,700	55%	130
Philadelphia	4,167	9,622	0.17	1,068,464	2,215,246	157%	653
Portland	3,919	5,465	2.0	204,390	498,564	0	19
Roanoke	168	512	16.0	12,480	46,441	0	2
San Francisco (South Bay)	72	Unknown	Unknown	213,917	400,340	30%	--
Tulsa	3,711	4,353	4.6	137,584	402,634	0	7

BOD = Total BOD_5 loading rate for urban area in pounds per day

Q_{DS} = Total receiving water flow rate downstream of urban area in cubic feet per second

K_2 = Reaeration coefficient of receiving water downstream of urban area in day^{-1} (base e)

Values of this parameter for each of the ten study sites, except for the San Francisco Bay Area, are reported in Column 8 of Table 6.2.

The basic waste loading data for Philadelphia, Milwaukee, and Des Moines were modified, and receiving water dissolved oxygen response curves were recomputed based on these new waste loadings, in order to generate additional data. These data are reported in Table 6.3. In the case of Philadelphia, the point source waste strengths were reduced to conform with the allocated waste loadings assigned to these sources. Because this case represents a possible future condition, the DO response curves and waste load information are reported in Appendix A.

Modification to the Des Moines data and Milwaukee data on the other hand were arbitrary and do not represent likely future conditions. The Des Moines analysis indicated a need for a small reduction in BOD loading to meet standards. Therefore, the stormwater runoff portion of the BOD loading was doubled to generate a data point indicating a need for greater BOD removal. In the case of Milwaukee, a need for substantial BOD reduction was indicated by the base data. Therefore, the stormwater runoff portion of the BOD loading was both increased by 100 percent and decreased by 50 percent in order to generate two additional data points.

All data points reported in Tables 6.2 and 6.3 were plotted on semi-log paper as shown in Figure 6.3. The heavy line shown on this figure is the general relationship resulting from the dissolved oxygen response analysis of the ten selected study sites. This relationship is general and can be applied to any desired combination of design storm magnitude and receiving water flow conditions.

Inspection of Figure 6.3 reveals that when an urban area receiving water system produces a quality parameter value less than 70, then no treatment of stormwater runoff or combined sewer overflow would be required to meet a stream oxygen criteria of 5.0 mg/1, for the design storm runoff. If the quality parameter is in the approximate range of 70 to 300, then varying degrees of treatment will be required to meet the 5.0 mg/1 standard. For quality parameters greater than 300, treatment of stormwater and combined sewer overflow, as well as additional point source treatment facilities, will be required to meet wet weather criteria. Values of the quality parameter, as defined above, were computed for each urbanized area and applied to the curve presented in Figure 6.3 to estimate the required level of treatment for use in the national needs computations.

TABLE 6.3

SUMMARY OF ADDITIONAL RECEIVING WATER IMPACT ANALYSES AND BOD TREATMENT REQUIREMENTS

Study Site (1)	Base Flow cfs (2)	Total Flow cfs (3)	K_2 day^{-1} (4)	BOD_5 #/day (5)	UOD #/day (6)	Overall BOD Removal Req. (7)	$\frac{BOD_5}{Q_{total}K_2}$ (8)
Philadelphia (P_1)[1]	4,167	9,622	0.17	888,434	2,054,828	123%	543
Des Moines(I_1)[2]	2,186	3,346	1.9	754,400	1,602,180	55%	119
Milwaukee (M_1)[3]	170	467	1.1	42,400	162,800	0%	83
Milwaukee (M_2)[4]	170	467	1.1	116,200	318,500	88%	226

[1] Analysis based on allocated point source wasteloads.
[2] Analysis based on twice actual stormwater wasteloads.
[3] Analysis based on one half actual stormwater and combined sewer overflow wasteloads.
[4] Analysis based on twice actual stormwater and combined sewer overflow wasteloads.

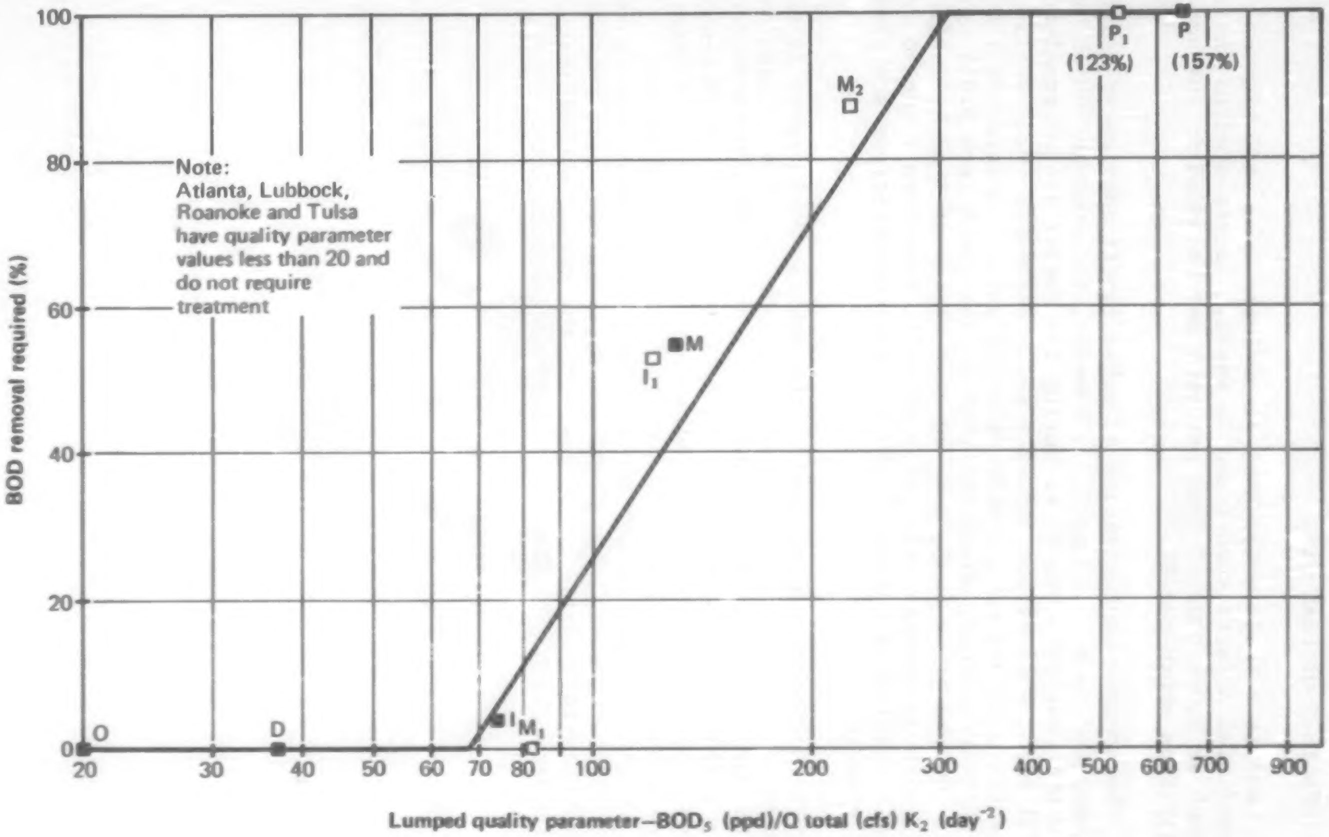

FIGURE 6.3. RELATIONSHIP BETWEEN LUMPED QUALITY PARAMETER AND REQUIRED BOD REMOVAL.

6.4 ANALYSIS OF LEAD DATA

Lead is a toxic metal that accumulates in animal tissues and has no beneficial affects when found in water. Recent studies indicate that as much as 5,000 tons of lead per year may be added to the aquatic environment from urban runoff.[36]

The average concentration in urban runoff samples at Atlanta has been reported to be 0.15 mg/l.[11] However, the average concentration of lead in the Chattahoochee River during the summer months remained below 0.001 mg/l, well within drinking water standards (0.05 mg/l). Lead concentrations are also within drinking water standards in the polluted Delaware estuary where observed values range from 0.004 mg/l to 0.02 mg/l. On the other hand, lead concentrations of from 0.10 mg/l to 2.86 mg/l, with an average value of 0.46 mg/l, have been reported for urban runoff samples in Durham.[17] Such high concentrations are clearly cause for concern.

The ultimate role of lead in the aquatic environment is not well understood. However, it is known that lead toxicity to fish is a function of water hardness and pH and, therefore, safe concentration limits are difficult to establish. The estimated removal efficiencies of lead and other toxic substances obtained by the primary treatment process are shown in Table 3.2. The national estimate of needs developed in this study does not consider removal of lead from stormwater. Should such removal become necessary, treatment requirements could be substantially increased. However, the use of source controls for toxic substances may be a more cost effective solution.

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PART III

NATIONAL NEEDS ASSESSMENT

Section 7

NATIONAL ASSESSMENT METHODOLOGY

The national assessment of needs for control of urban stormwater pollution must be based on accurate, readily available data which is directly related to the stormwater problem. In the development of the resulting needs estimates, the data base must be current and well documented; the methodology must represent the technology available for the control and/or treatment of urban stormwater pollution, and any required assumptions must be reasonable.

The Needs Estimation Model for Urban Runoff (NEMUR) was developed specifically for the 1976 Needs Survey-Categories V and VI. NEMUR utilizes a consistent methodology to calculate the present and 1990 capital costs and operation and maintenance costs for combined sewered (Category V) and separate storm sewered (Category VI) control and/or treatment needs for all urbanized areas. The separate estimates are combined to provide a state-by-state and national needs estimate for three receiving water quality criteria.

Predictive methods, cost estimating equations and assumptions used in NEMUR are based on an intensive search of the literature related to urban stormwater runoff. Where insufficient specific research could be found to adequately define a predictive method; information developed in the specific site analyses is utilized.

For selected wet weather conditions, the model determines the total pollutant loads discharged from wastewater treatment facilities, combined sewer overflows, and other stormwater discharges. The input data characterizes the individual drainage areas by population, land area, and receiving water factors, such as flow rate and reaeration capacity. Using the calculated pollutant loadings, and receiving water factors, NEMUR then estimates the level of treatment required to maintain water quality criteria within the urbanized area's major receiving water.

For the Aesthetics, Fish and Wildlife, and Recreation water quality criteria, NEMUR computes the least cost combination of pollutant control options for combined sewer overflows and other stormwater discharges. Discharges from wastewater treatment facilities are assumed to receive adequate treatment. Finally, NEMUR estimates costs for the individual control level found most effective in each urbanized area and totalizes the cost estimates for all urbanized areas in each state.

The program for NEMUR consists of numerous computations, which are generalized in Figure 7.1, and five subprograms, each with specific functions as is shown in Figure 7.2. The following sections of the report provide a concise and detailed definition and example of the data base, methodologies, and assumptions utilized in NEMUR.

FIGURE 7.1

NEMUR
GENERAL COMPUTATION SCHEMATIC

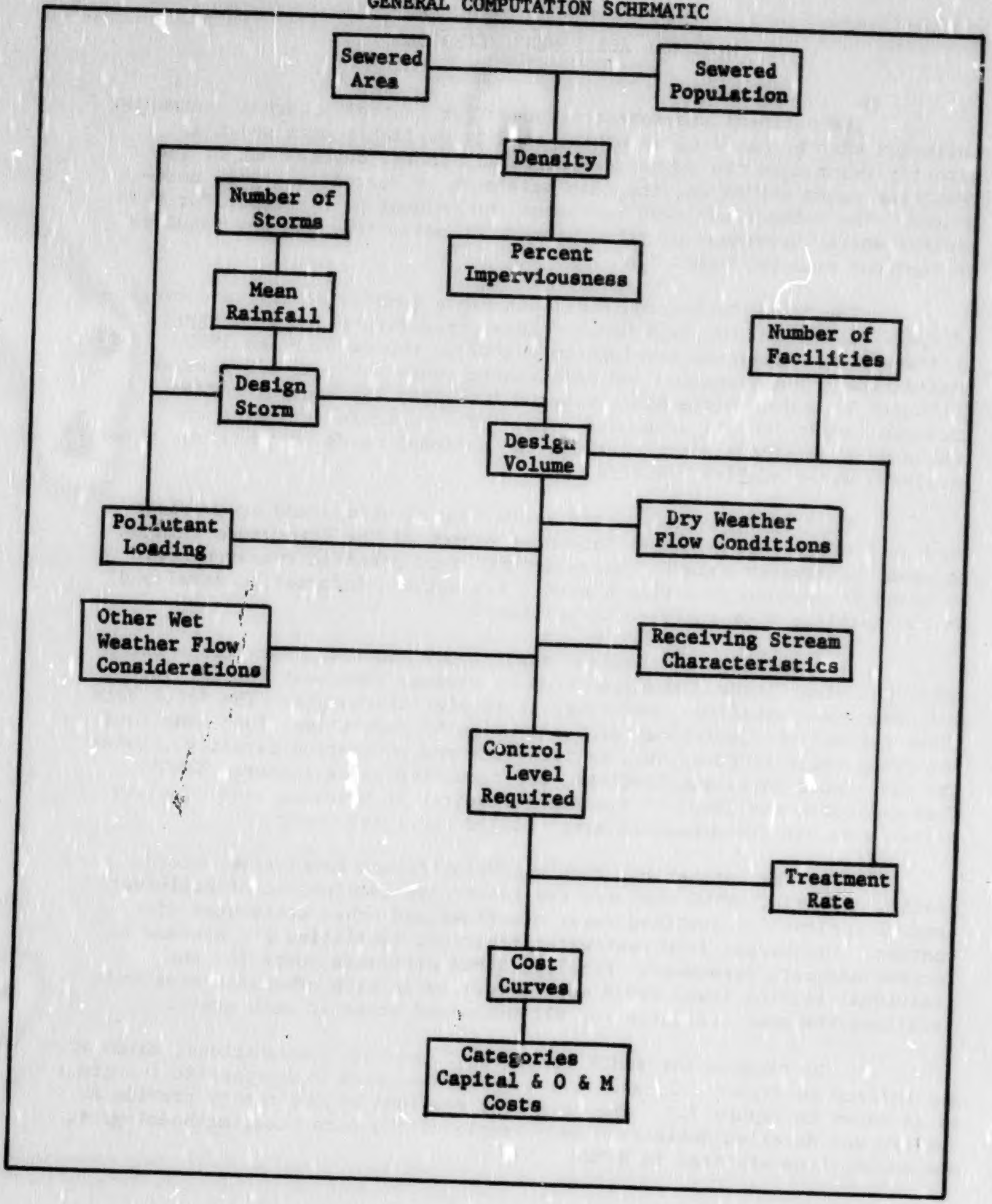
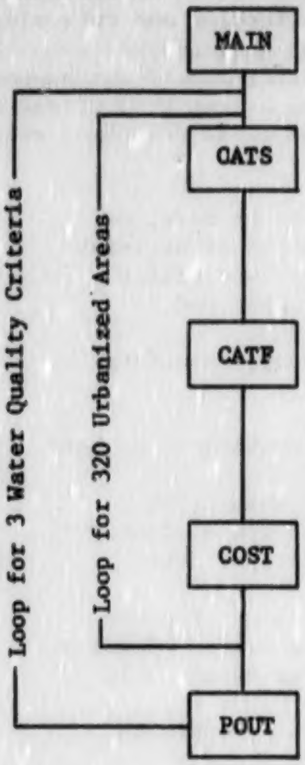

Sewered Area
Sewered Population
Density
Number of Storms
Percent Imperviousness
Mean Rainfall
Number of Facilities
Design Storm
Design Volume
Pollutant Loading
Dry Weather Flow Conditions
Other Wet Weather Flow Considerations
Receiving Stream Characteristics
Control Level Required
Treatment Rate
Cost Curves
Categories Capital & O & M Costs

FIGURE 7.2

NEMUR
SUBPROGRAM FUNCTIONS


MAIN
CATS
CATF
COST
POUT
Loop for 3 Water Quality Criteria
Loop for 320 Urbanized Areas

MAIN reads and prints demographic, hydrological, and control data

CATS calculates population density, imperviousness, volume of runoff, curb miles, area growth and pollutant loading for the storm sewered area of each UA

CATF calculates volume of runoff, pollutant loading and treatment rates for the combined sewered area of each UA and the total pollutant removal required to meet water quality criteria

COST identifies the respective levels of treatment for stormwater runoff and combined sewer overflows to best meet the total pollutant removal and calculates the capital and O & M costs for each UA

POUT prints needs for each UA and sums by state and nation

7.1 DEMOGRAPHIC DATA

Regulations for the application of the NPDES Permit Program to separate storm sewers were published in the Federal Register of March 18, 1976[1]. In these regulations, the term "separate storm sewer" is defined as "a conveyance or system of conveyances . . . located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff". Based on this guideline, the geographical area which requires control and/or treatment of urban stormwater runoff was assumed to be the urbanized areas of the nation as defined by the U.S. Bureau of Census. The specific criteria for the delineation of an urbanized area are as follows:

- A central city of 50,000 inhabitants or more, or twin cities with a combined population of at least 50,000, and with the smaller of the twin cities having a population of at least 15,000; and
- Surrounding closely settled territory, including the following:
  - incorporated places of 2,500 inhabitants or more
  - incorporated places with fewer than 2,500 inhabitants, provided that each has a closely settled area of 100 housing units or more
  - small parcels of land normally less than one square mile in area having a population density of 1,000 inhabitants or more per square mile
  - other similar small areas in unincorporated territory with lower population density provided that they serve to eliminate enclaves, or to close indentations in the urbanized areas of one mile or less across the open end, or to line outlying enumeration districts of qualifying density that are not more than 1 1/2 miles from the main body of the urbanized area.

As of January 1, 1976, there were 279 urbanized areas defined in the nation. Thirty-five of the urbanized areas encompassed area in two states and three urbanized areas encompassed area in three states. By subdividing the urbanized areas encompassing more than one state, a total of 320 areas were defined for estimation of Category V and VI needs. Category V needs for areas served by combined sewers but outside of urbanized areas were included on a state-by-state basis.

The 1970 census population and land area for each of the 320 areas were obtained from the U.S. Bureau of Census. The population and area of each urbanized area served by combined sewers were developed by the American Public Works Association (APWA) and the University of Florida[2]. Estimated state and standard metropolitan statistical area populations for 1990 were obtained from the U.S. Water Resources Council's OBERS projections[3] and state populations were modified to be consistent with the 1990 ceiling populations utilized in the 1974 Needs Survey[4].

In the 1967 inventory of local authorities with combined sewer systems, conducted by APWA[5], the number of combined sewer overflows and the area served by combined sewer overflows was reported by state. This information was utilized to estimate the average drainage area to each combined sewer overflow structure on a state-by-state basis.

The cost indices used in the 1976 Needs Survey are the Environmental Protection Agency Sewage Treatment Plant Cost Index for January 1976 of 255.7 for treatment plants and 266.5 for sewers. These indices have a 1957-1959 base of 100. City multipliers are determined by EPA for twenty-five index cities. Areas of influence were assigned to each of the index cities based on geographical proximity and other factors. Cost indices for specific urbanized areas are listed in Appendix B.

7.2 HYDROLOGIC DATA

The amount of rainfall each year and the distribution of rain throughout the year are factors which cause urban stormwater runoff. Data defining the average annual rainfall and the average number of days per year with measurable precipitation for each urbanized area were obtained from the National Oceanic and Atmospheric Administration[6]. This information is required to determine the quantity and quality of urban stormwater runoff for a specific area.

Since this rainfall data alone does not identify the impacts of the pollutant loads upon receiving waters, a detailed description of the receiving waters for each urbanized area and complex dynamic water quality modeling is required to specifically identify the level of urban stormwater control needed to prevent water quality violations. This level of detail is beyond the scope of this project and, thus, readily available information was utilized to describe the receiving waters of each urbanized area. First, the receiving water draining the largest percentage of each urbanized area was identified from U.S. Geological Survey topographical maps. This percentage was estimated and a verbal description of the receiving water was selected from Table 7.1 based on information contained on the topographical maps. Reaeration rates were assigned to the verbal descriptions based on the literature[7, 8].

The average flow for the lowest three months of the year for each receiving water was then estimated. When available, five years of USGS streamflow records[9] were summarized to obtain this flow value. Where

TABLE 7.1

VERBAL DESCRIPTION OF RECEIVING WATERS

Data Code	Receiving Water Description	Estimated Reaeration Rate - K_2(day^{-1}) Base e at 20°C
1	Creeks and shallow streams	4.75
2	Upstream feeders	1.75
3	Intermediate channels	0.75
4	Main drainage rivers	0.32
5	Large rivers	0.18
6	Impounded rivers	0.08
7	Small ponds, backwaters	0.15
8	Large lakes	0.30
9	Shallow, high tidal velocity estuary or bay	0.80
10	Shallow, low tidal velocity estuary or bay	0.50
11	Medium depth, high tidal velocity estuary or bay	0.40
12	Medium depth, low tidal velocity estuary or bay	0.15
13	Deep, low tidal velocity estuary or bay	0.06
14	Deep, high tidal velocity estuary or bay	0.12
15	Open ocean or beach	0.50

there were no nearby gaging stations, where several streams flowed together, or other factors made direct calculation of flow values impractical, statistical flow summaries, water quality reports, and other data were used to aid in estimation of the annual three month low flow.

7.3 MODEL DESCRIPTION

By utilizing the demographic and hydrologic data described above, which are listed in Appendix B, the receiving water quality methodology developed in Section 6, and the control and/or treatment cost equations developed in Section 3, a computer-assisted mathematical model was developed to estimate the national needs for stormwater control.

The Needs Estimation Model for Urban Runoff (NEMUR) utilizes a consistent methodology to calculate the present and 1990 capital and operation and maintenance costs for combined sewered (Category V) and separate storm sewered (Category VI) control and/or treatment needs for each urbanized area in the nation. The needs estimates are then summed to provide a state-by-state and national estimate. The program listing is shown in Appendix C. The specific methodologies utilized in NEMUR are developed in the following sections through the use of an example urbanized area.

7.4 EXAMPLE URBANIZED AREA DESCRIPTION

A simplified map of a hypothetical urbanized area to be used throughout the specific methodology development is shown in Figure 7.2. The input data required for the example are shown in Table 7.2. At each step of the methodology development, the method is discussed and documented and example calculations are shown. Abbreviations are the same as used in NEMUR to allow cross reference, are identified after each calculation to assure easy comprehension, and are also defined in the List of Abbreviations.

7.5 RUNOFF QUANTITY CALCULATIONS

The quantity of runoff requiring control is determined from a design storm runoff coefficient approach similar to the methodology used in STORM[10]. Although this approach neglects the variable volume and spacing of rainstorms, the effects of storm size on runoff coefficients and other specific phenomena, use of design storm and an average runoff coefficient is a simplified technique which has been widely used. Runoff volumes are computed separately for the combined sewered and the storm sewered portions of each urbanized area.

Population densities for the combined and storm sewered areas are computed directly from the input data as follows:

$$\mathrm{LAND} = \mathrm{UA} - \mathrm{CSA} \quad (7.1)$$

$$\mathrm{POP} = \mathrm{UAP} - \mathrm{CSAP} \quad (7.2)$$

$$\mathrm{PDSS} = \mathrm{POP/LAND} \quad (7.3)$$

$$\mathrm{PDCS} = \mathrm{CSAP/CSA} \quad (7.4)$$

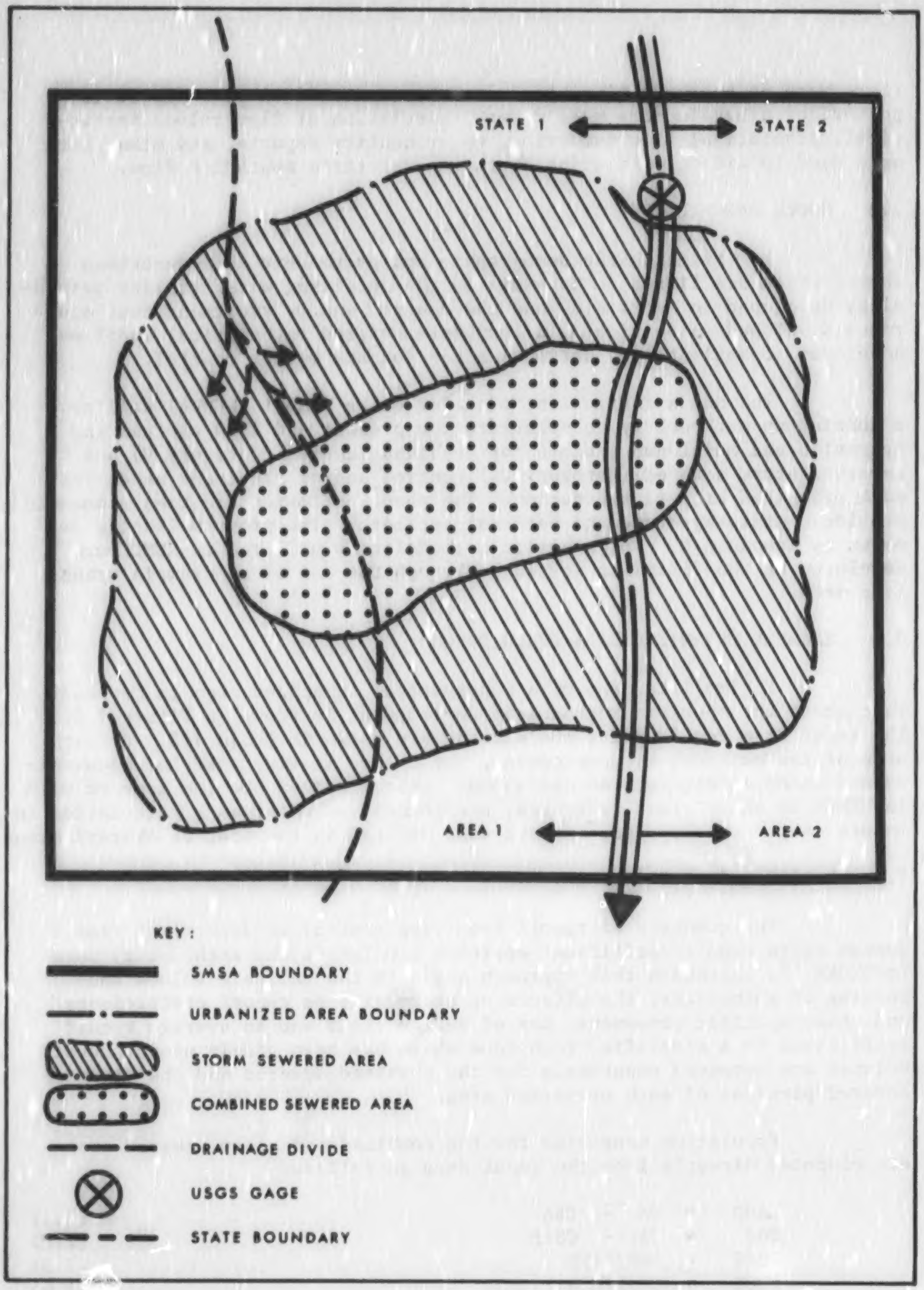

STATE 1
STATE 2
AREA 1
AREA 2
KEY:
SMSA BOUNDARY
URBANIZED AREA BOUNDARY
STORM SEWERED AREA
COMBINED SEWERED AREA
DRAINAGE DIVIDE
USGS GAGE
STATE BOUNDARY

FIGURE 7.3
EXAMPLE URBANIZED AREA SCHEMATIC

TABLE 7.2

INPUT DATA FOR EXAMPLE URBANIZED AREA

Input Data Description	Example Urbanized Area Values	
	AREA 1	AREA 2
1990 State Populations		
OBERS ($\text{State}_{\text{OBERS}}$)	5,438,000	2,281,000
EPA Ceiling ($\text{State}_{\text{EPA}}$)	5,488,000	2,509,000
Combined Sewer Area (acres) (CSA)	14,200	200
Combined Sewer Population (CSAP)	60,000	500
Average Drainage Area per Combined Sewer Overflow (acres) (ASCO)	415	381
Urbanized Area		
Populations (UAP)	75,940	1,283
Areas (sq. mi.) (UA)	30.7	1.2
SMSA Populations		
1970 (SMSA_{70})	87,205	87,205
1990 (SMSA_{90})	89,300	89,300
Average Days with Rain Per Year (ADR)	95	95
Average Yearly Rainfall (inches) (ARF)	34.18	34.18
Receiving Stream Classification	4	4
EPA Cost Index	1.0	1.0

where:

UA = area of urbanized area in acres

CSA = combined sewered area in acres

LAND = separate storm sewered area in acres

UAP = 1970 population of urbanized area

CSAP = 1970 population in urbanized area served by combined sewers

POP = 1970 population of storm sewered area

PDSS = population density of storm sewered area in people/acre

PDCS = population density of combined sewered area in people/acre.

Relationships between development parameters, such as imperviousness and curb lengths, and demographic parameters, such as population density, have been developed statistically by several investigators. Graham, et al.[11] developed equations predicting imperviousness and specific curb length based on the population densities of 32 census tracts in the Washington, D.C. area. Stankowski[12] developed similar equations based on 536 New Jersey municipalities. Stankowski's equation, which is used to estimate imperviousness in NEMUR, is:

$$\text{SSI} = 9.6\ \text{PDSS}^{(0.573 - 0.0391 \log_{10}\text{PDSS})} \qquad (7.5)$$

where:

SSI = Percent imperviousness in storm sewered area.

The runoff coefficient, ROCS, for the storm sewered area is calculated by weighing the pervious and impervious portions of the urbanized area and assuming a runoff coefficient for each. The equation is:

$$\text{ROCS} = 0.15\ (1-\text{SSI}) + 0.90\ \text{SSI}$$

or:

$$= 0.15 + 0.75\ \text{SSI} \qquad (7.6)$$

where SSI is the imperviousness as a fraction and the coefficients 0.15 and 0.90 are assumed runoff coefficients from pervious and impervious areas, respectively. This parameter allows the direct estimation of runoff volumes from rainfall volumes.

The design storm criteria selected are: the 80 percentile storm for all stormwater facilities; the 90 percentile storm for treatment of combined sewer overflow to meet the aesthetics and fish and wildlife criteria; and the 98 percentile storm for treatment of combined sewer overflow to meet the recreation criteria. Thus, the design storm is defined as that depth of rainfall at which the cummulative frequency of observed rainfall depths is 80, 90, or 98 percent, dependent upon the type of urban runoff and receiving water quality to be achieved. These values were computed for each urbanized area as follows:

$$DS_x = K_x\ MRF \tag{7.7}$$

where:

DS_x = design rainfall depth cased on x percentile storm

K_x = a factor which converts the MRF to 80, 90, or 98 percentile storm depth (K_{80} = 1.61; K_{90} = 2.30; and K_{98} = 3.91)

MRF = mean rainfall depth per storm in inches, which is estimated by:

$$MRF = ARF/MNS \tag{7.8}$$

and:

$$MNS = 1.0026\ ADR-2.58 \tag{7.9}$$

where:

ARF = average annual rainfall in inches

MNS = mean number of rainstorms each year, and

ADR = average annual days of measurable rain

By utilizing the design storm size and the runoff coefficient, the design volume of runoff can be estimated as:

$$DVSS = DS\ (ROCS)(LAND)(.027158) \tag{7.10}$$

where:

DVSS = design runoff volume from the storm sewered area in million gallons

Similar calculations are used to calculate the design runoff volume from the combined sewered area. Example calculations are shown in Table 7.3.

7.6 RUNOFF QUALITY CALCULATIONS

The American Public Works Association and the University of Florida[2] developed a pollutant loading prediction methodology based on precipitation and population density. Measured mass pollutant discharges from various combined and storm sewered catchment areas in the United States and Canada were related functionally to precipitation and population functions. The resultant equations allow the prediction of average annual pollutant

TABLE 7.3

EXAMPLE RUNOFF QUANTITY CALCULATIONS

CATEGORY VI
Land Area Containing Storm Sewers (LAND) LAND = UA-CSA = 30.7 (640)- 14,200 = 5,448 acres
Population in Storm Sewer Area (POP) POP = UAP - CSAP = 75,940 - 60,000 = 15,940
Population Density in Storm Sewered Area (PDSS) PDSS = POP/LAND = 15,940/5,448 = 2.93 People/Acre
Percent Imperviousness in Storm Sewered Area (SSI) $SSI = 9.6\ PDSS^{(0.573 - 0.0391\ LOG_{10} PDSS)}$ $= 9.6(2.93)^{(0.573 - 0.0391\ LOG_{10} 2.93)} = 17.43\%$
Runoff Coefficient in Storm Sewered Area (ROCS) ROCS = 0.75 (SSI/100) + 0.15 = 0.75 (17.43/100) + 0.15 = 0.28
Mean Number of Storms per year (MNS) MNS = 1.0026 (ADR) - 2.58 = 1.0026 (95) - 2.58 = 92.67
Mean Annual Rainfall (MRF) MRF = ARF/MNS = 34.18/92.67 = 0.369 in.
Design Storm (DS) DS_{80} = 1.61 (MRF) = 1.61 (0.369) = 0.59 in.
Design Volume of Storm Sewer Treatment DVSS = DS (LAND) ROCS (0.027158 MG/ACRE-IN) = 0.59 (5,448) 0.28 (0.027158) = 24.44 MG

TABLE 7.3 (Cont'd)

EXAMPLE RUNOFF QUANTITY CALCULATIONS

CATEGORY V

Population Density of Combined Sewered Area (PDCS)

PDCS = CSAP/CSA

= 60,000/14,200 = 4.23 people/acre

Percent Imperviousness of Combined Sewered Area (CSI)

$$\text{CSI} = 9.6\ \text{PDCS}^{(0.573 - 0.0391\ \text{LOG}_{10}\ \text{PDCS})}$$

$$= 9.6\ (4.23)^{(0.573 - 0.0391\ \text{LOG}_{10}\ 4.23)} = 21.17\ \%$$

Runoff Coefficient of Combined Sewered Area (ROC)

ROC = 0.15 + 0.75 (CSI/100)

= 0.15 + 0.75 (21.17/100) = 0.31

Design Volume of Combined Sewer Treatment (DVCS)

DVCS = DS (ROC) CSA (0.027158 MG/ACRE-IN)

= 0.59(0.31) (14,200) 0.027158 = 70.53 MG loading rates for various pollutants such as BOD$_5$, suspended solids, volatile solids, phosphate and nitrogen. The authors state, "Unquestionable, the data base for estimating pollutant loads is very weak and the resulting estimating equations, supported by such a weak foundation should be used with extreme caution." Therefore, the pollutant loadings developed must be considered as approximate estimates of a highly variable phenomena. However, the following equations provide the best uniform means available for estimating pollutant loadings for the urbanized areas. The predictive equations are:

$$POL_{BOD,CSO} = (1.73\ DS(0.142 + 0.218\ PDCS^{0.54}) + 1.9\ DS)\ CSA \tag{7.11}$$

$$POL_{SS,CSO} = (39.2\ DS(0.142 + 0.218\ PDCS^{0.54}) + 25.94\ DS)\ CSA \tag{7.12}$$

$$POL_{BOD,SSA} = (0.420\ DS(0.142 + 0.218\ PDSS^{0.54}) + 0.462\ DS)\ LAND \tag{7.13}$$

$$POL_{SS,SSA} = (9.52\ DS(0.142 + 0.218\ PDSS^{0.54}) + 25.94\ DS)\ LAND \tag{7.14}$$

where:

$POL_{i.j}$ = the pollutant loading of the ith constitutent from the jth area in pounds per storm event

BOD = BOD$_5$ in pounds per storm event

SS = suspended solids in pounds per storm event

CSO = combined sewered area

SSA = separate sewered area

DS = design storm size in inches

PDCS = population density of the combined sewered area in people/acre

PDSS = population density of the storm sewered area in people/acre

CSA = area served by combined sewers in acres, and

LAND = area served by separate sewers in acres

Example calculations are shown in Table 7.4.

7.7 DRY WEATHER FLOW QUANTITY AND QUALITY CALCULATIONS

The pollutant loadings from dry weather point sources, such as municipal and industrial wastewater treatment plants, are assumed to receive

TABLE 7.4

EXAMPLE RUNOFF QUALITY CALCULATIONS

BOD Loading in Combined Sewered Area ($POL_{BOD,CSO}$)

$$\begin{aligned} POL_{BOD,CSO} &= [1.73\ DS\ (0.142 + 0.218\ PDCS^{0.54}) + 1.9\ DS]\ CSA \\ &= [1.73(0.59)(0.142+(0.218)4.23^{0.54}) + (1.9)0.59]\ 14{,}200 \\ &= 24{,}860 \text{ pounds/storm event} \end{aligned}$$

Suspended Solids Loadings in Combined Sewered Area ($POL_{SS,CSO}$)

$$\begin{aligned} POL_{SS,CSO} &= [39.2\ DS\ (0.142 + 0.218\ PDCS^{0.54}) + 25.94\ DS]\ CSA \\ &= [39.2(0.59)(0.142 + (0.218)\ 4.23^{0.54}) + (25.94)\ 0.59]\ 14{,}200 \\ &= 419{,}950 \text{ pounds/storm event} \end{aligned}$$

BOD Loading in Storm Sewered Area ($POL_{BOD,SSA}$)

$$\begin{aligned} POL_{BOD,SSA} &= [\ 0.42\ DS\ (0.142 + 0.218\ PDSS^{0.54}) + 0.462\ DS]\ LAND \\ &= [\ 0.42(0.59)[0.142 + (0.218)2.93^{0.54}) + (0.462)0.59]\ 5{,}448 \\ &= 2{,}200 \text{ pounds/storm event} \end{aligned}$$

Suspended Solids Loading in Storm Sewered Area ($POL_{SS,SSA}$)

$$\begin{aligned} POL_{SS,SSA} &= [9.52\ DS\ (0.142 + 0.218\ PDSS^{0.54}) + 25.94\ DS]\ LAND \\ &= [9.52\ (0.59)\ (0.142+(0.218)\ 2.93^{0.54}) + (25.94)0.59]\ 5{,}448 \\ &= 99{,}645 \text{ pounds/storm event} \end{aligned}$$

secondary treatment and that each population equivalent contributes:

- 125 gallons of wastewater per day, and
- 0.0255 pounds of BOD_5 per day after treatment.

Therefore, the predictive equations developed for estimating the quantity and quality of dry weather wastewater flows are:

$$DWF = 0.00019\ UAP \tag{7.15}$$

$$DWB = 0.0255\ UAP \tag{7.16}$$

where:

DWF = dry weather flow in cfs

DWB = dry weather BOD_5 in pounds per day

UAP = urbanized area population.

Example calculations are shown in Table 7.5.

7.8 RECEIVING WATER CONSIDERATIONS

A method for determining the required level of BOD_5 removal to maintain the fish and wildlife criteria was developed in Section 6. The required removal of BOD_5 due to combined sewer overflows and stormwater runoff was shown to be directly related to the total BOD_5 loading discharged to the stream, and inversely related to the stream flow downstream of the urbanized area and the reaeration rate of the receiving water. The predictive parameter used to estimate the required removal rate is:

$$RF = \frac{BOD}{Q_{DS}K_2} \tag{7.17}$$

and:

$$BOD = ((POL_{BOD,CSO} + POL_{BOD,SSA})/DSD + DWB)\ PSTR \tag{7.18}$$

$$Q_{DS} = (3.05\ (DVCS + DVSS)\ DWF)\ PSTR + STR \tag{7.19}$$

where:

RF = predictive water quality parameter

POL = as previously defined

BOD = total BOD_5 loading from an urbanized area in pounds/day

TABLE 7.5

EXAMPLE DRY WEATHER FLOW QUANTITY AND QUALITY CALCULATIONS

Dry Weather Flow in Urbanized Area (DWF)

DWF = 0.00019 UAP

= 0.00019 (75,940) = 14.4 cfs

BOD Dry Weather Loading in Urbanized Area (DWB)

DWB = 0.0255 UAP

= 0.0255 (75,940) = 1,936 pounds/day

Q_{DS} = total receiving water flow downstream from an urbanized area in cfs

K_2 = reaeration coefficient - base e at 20°C in Day^{-1}

DSD = design storm duration in days, assumed to be 0.5 days

PSTR = fraction of urbanized area drained by selected receiving water

DWF = dry weather wastewater discharge in cfs

STR = receiving water flow in cfs.

The required removal rate is then estimated by:

$$RF < 69 \qquad RR = 0 \tag{7.20}$$

$$69 < RF < 225 \quad RR = 184.7 \log_{10} RF - 339.6$$

$$RF > 225 \qquad RR = 95$$

where:

RR = total required percentage of BOD_5 removal due to stormwater runoff

Where two or more urbanized areas are located in close proximity on the same receiving water, such as urbanized areas encompassing more than one state but which were delineated by state for purposes of the 1976 Needs Survey, the available receiving water flow was apportioned to each urbanized area directly proportional to the total pollutant loads. Example calculations are shown in Table 7.6.

7.9 LEVEL OF TREATMENT SELECTION

Three water quality criteria and five levels of control and/or treatment for combined sewer overflows and stormwater discharges were identified in Section 3. After review of the available literature on the effectiveness of stormwater treatment systems, the following assumptions were made relating required treatment and/or control levels to water quality criteria:

1. Aesthetic Criteria: Best Management Practices (assumed to consist of sweeping all streets once per week, construction practices, and provision of detention basins in newly developing areas) would be applied to all urbanized areas as a minimum control level for storm sewered areas. Swirl Concentrators with

TABLE 7.6

EXAMPLE RECEIVING WATER CONSIDERATIONS

Percent of Stream Flow Assigned to STATE1 (PSF_{STATE1})

$$PSF_{STATE1} = BOD_{5,STATE1}(PSTR_{STATE2})/[BOD_{5,STATE1}(PSTR_{STATE1}) + BOD_{5,STATE2}(PSTR_{STATE2})]$$

where:

$$BOD_{5,STATE1} = (POL_{BOD,CSO,STATE1} + POL_{BOD,SSA,STATE1})/DSD + DWB_{STATE1}$$
$$= (24,860 + 2,200)/.5 + 1,935$$

$$BOD_{5,STATE2} = 1,278.7$$

$$PSF_{STATE1} = .8(56,055)/[56,055(.8)+1,278.7(1.0)]$$
$$= 0.972\%$$

Stream Flow Attributed to STATE1 (STR_{STATE1})

$$STR_{STATE1} = PSF_{STATE1}(STR)$$
$$= 0.972\ (1,250)$$
$$= 1,215\ \text{cfs}$$

Removal Factor (RF)

$$RF = BOD_{5,STATE1}/[Q_{DS,STATE1}(K2)]$$

where:

Downstream Flow for STATE1 ($Q_{DS,STATE1}$)

$$Q_{DS,STATE1} = [1.55\ (DVSS+DVCS)/DSD+DWF_{STATE1}]PSTR_{STATE1}+STR_{STATE1}$$
$$= [1.55(24.44+70.53)/.5+14.4].8+1,215$$
$$= 1,462\ \text{cfs}$$

Reaeration Coefficient (K2)
$K2 = 0.32$ 1/day

$$RF = 56,055/[1,462(.32)] = 119.8$$

Since $69 < RF < 225$

Percent Pollutant Removal Required (RR)

$$RR = [184.7\ LOG_{10}\ (RF) - 339.6]/100$$
$$= [184.7\ LOG_{10}\ (105.74) - 339.6]/100 = 0.443$$

fine screening of the concentrate were sized for all combined sewered areas as a minimum control level. These treatment and/or control levels should provide significant removals of oil, scum. large settleable solids, and other unaesthetic debris.

2. Fish and Wildlife Criteria: The total percentage of BOD_5 removal required to meet this criteria was determined earlier. However, several combinations of Categories V and VI treatment could be used to meet that total removal. Based on a cost-effectiveness analysis and noting that concentrations of pollutants from combined sewer overflows are much higher than from storm sewer discharges, higher combinations of treatment and/or control levels are progressively evaluated for each urbanized area to obtain the required removal of pollutants at the least cost. The progression of treatment combinations is shown in Table 7.7. After the BOD_5 criteria has been met, the concentration of suspended solids is calculated and checked against the maximum stream standard of 400 mg/l. If the suspended solids concentration is greater than 400 mg/l, the treatment combination is increased until both the dissolved oxygen and suspended solids criteria are met.

3. Recreation Criteria: Disinfection to control pathogenic bacteria is added to the treatment levels assigned for the Fish and Wildlife Criteria. This estimate should be evaluated with care since chlorination is the selected method of disinfection, and in some cases dechlorination may be required. Example calculations are shown on Table 7.8.

7.10 OTHER REQUIRED CALCULATIONS

Several calculations relating to Best Management Practices are required to obtain the costs and effectiveness of these practices. First, the growth of land area in each urbanized area between the present and 1990 must be defined. However, projections of neither the 1990 population nor area of urbanized areas was readily available. Therefore, the OBERS projections for standard metropolitan statistical areas developed by the U.S. Water Resources Council[3] were used with several assumptions to define the 1990 area of each urbanized area. First, it was assumed that no new combined sewers would be constructed. Thus, the present and 1990 needs for Category V will be the same and all growth is assumed to be served by storm sewers. Next, the population density of the storm sewered area is assumed

TABLE 7.7

SUCCESSIVE TREATMENT AND/OR CONTROL COMBINATIONS BASED ON COST EFFECTIVENESS EVALUATION

Treatment and/or Control Combination	Combined Sewer Treatment Level (Predicted BOD_5 Removal)	Storm Sewer Control and/or Treatment Level (Predicted BOD_5 Removal)
1	Screening - Swirl Concentration (0-25)	BMP (0-25)
2	Sedimentation (25-40)	BMP (0-25)
3	Air Floatation (40-60)	BMP (0-25)
4	Flocculation - Sedimentation (60-80)	BMP (0-25)
5	Air Floatation (40-60)	Sedimentation (25-40)
6	Flocculation - Sedimentation (60-80)	Sedimentation (25-40)
7	Flocculation - Sedimentation (60-80)	Air Floatation (40-60)
8	Filtration (80-95)	BMP (0-25)
9	Filtration (80-95)	Sedimentation (25-40)
10	Filtration (80-95)	Air Floatation (40-60)
11	Filtration (80-95)	Flocculation - Sedimentation (60-80)
12	Filtration (80-95)	Filtration (80-95)

TABLE 7.8

EXAMPLE LEVEL OF TREATMENT CALCULATIONS

For $LEVEL_{CSO} = 1$ and $LEVEL_{SSA} = 1$

Percent BOD Removed (PR1)

$PR1 = [0.25(POL_{BOD,CSO})+PPRS(POL_{BOD,SSA})]/(POL_{BOD,CSO}+POL_{BOD,SSA})$

$= [0.25\ (24{,}860)+.22(2{,}200)]/(24{,}860+2{,}200) = 0.247$

Since PR1 < RR you must proceed to the next treatment level combination

---

For $LEVEL_{CSO} = 2$ and $LEVEL_{SSA} = 1$

$PR1 = [(0.4)POL_{BOD,CSO}+\ (PPRS)\ POL_{BOD,SSA}]/(POL_{BOD,CSO}+POL_{BOD,SSA})$

$= [0.4(24{,}860) + .22(2{,}200)]/(24{,}860 + 2{,}200) = .385$

Since PR < RR go to next treatment level combination

For $LEVEL_{CSO} = 3$ and $LEVEL_{SSA} = 1$

$PR1 = [0.6(POL_{BOD,CSO}) + PPRS(POL_{BOD,SSA})]/(POL_{BOD,CSO}+POL_{BOD,SSA})$

$= [0.6(24{,}860) + .22\ (2{,}200)]/(24{,}860 + 2{,}200)$
$PR1 = .57$

Since PR1 > RR check to see if the suspended solids concentration is less than 400 mg/1

Suspended Solids Concentration (PR2)

$PR2 = [(0.3(POL_{SS,CSO}) +(1-PPRS)\ POL_{SS,SSA})/2(DVCS+DVSS)]\ 0.12$

$= [(0.3(419{,}950)+(1-.22)99{,}645)/2(70.53 + 24.44)]\ 0.12$
$= 128$ mg/1

Since PR2 < 400 mg/1 $LEVEL_{CSO} = 3$ and $LEVEL_{SSA} = 1$ are the treatment levels required to maintain the desired water quality criteria.

to remain constant. This means that the area will grow in the same proportion as the population. The 1990 population and land area of each urbanized area is estimated by:

$$POP_{90} = UAP\ (SMSA_{90}/SMSA_{70})(State_{EPA}/State_{OBERS}) \tag{7.21}$$

$$POP_{SS} = POP_{90} - CSAP \tag{7.22}$$

$$LAND_{90} = POP_{SS}/PDSS \tag{7.23}$$

$$LAND_{GROWTH} = LAND_{SS} - LAND \tag{7.24}$$

where:

POP_{90} = 1990 estimated population of each urbanized area

UAP = 1970 urbanized area population

$SMSA_{70}$ = 1970 census population of standard metropolitan statistical area containing the urbanized area

$SMSA_{90}$ = OBERS projected 1990 population for each SMSA

$State_{OBERS}$ = OBERS projected 1990 population for the state containing the urbanized area

$State_{EPA}$ = EPA 1990 ceiling population for the state

POP_{SS} = 1990 urbanized area population served by storm sewers

CSAP = 1970 population in urbanized area served by combined sewers

PDSS = population density of storm sewered area in people/acre

$LAND_{90}$ = 1990 urbanized area served by storm sewers in acres

LAND = 1970 urbanized area served by storm sewers in acres, and

$LAND_{GROWTH}$ = growth of urbanized area in acres.

Another factor related to Best Management Practices, which is at best poorly defined in the literature, is the pollutant removal effectiveness of street sweeping. Some research[13,14,15,16,17] has been conducted on the effectiveness of sweepers at removing pollutants from the street surfaces, but no information was found defining the portion of urban runoff pollutants which are washed from the street surface and the portion which are washed from other impervious areas (i.e., rooftops, parking lots, etc.) and pervious areas. Therefore, a methodology was developed based on the assumption that the concentration of pollutants from street surfaces prior to sweeping is twice that of other runoff.

Vacuum type street sweepers are assumed to be 95 percent efficient at removing pollutants from the street surface with two passes and considering the random occurrence of rainfall, the net annual efficiency of a once per seven day sweeping frequency was assumed to be 55 percent. These assumptions were taken from a study of the Washington, D.C. street sweeping program and computer analysis of rainfall patterns prepared by the Catholic University of America[13]. In each urbanized area, the acreage of street surfaces was estimated based upon a statistical relationship between curb miles and population density developed by Graham, et. al[11] and assuming an average street width of 34 feet. The street surface area was compared with the total impervious area and with the pervious area to develop a percentage of total runoff originating on street surfaces. Then the total pollutant removal efficiency of the assumed street sweeping program was calculated by:

$$\mathrm{PPRS} = (0.55)(2)\mathrm{PRDS}/(1-\mathrm{PRDS}) + 2(\mathrm{PRDS}) \qquad (7.25)$$

or:

$$\mathrm{PPRS} = 1.10\ \mathrm{PRDS}/1+\mathrm{PRDS}$$

where:

PPRS = percent pollutant removal from streets, and

PRDS = percent of urbanized area runoff from street surfaces.

Again, this procedure assumes that the concentration of stormwater runoff from street surfaces is twice that of other urban stormwater runoff, and that the street sweeping program assumed averages an annual pollutant removal of 55 percent from the street surfaces. Example calculations are shown on Table 7.9.

7.11 COST CALCULATIONS

Cost estimates for storage and treatment of combined sewer overflows are based on providing storage for the design storm runoff at each overflow point and pumping this stored volume at a reduced flow rate to one of a number of consolidated treatment plants throughout the urbanized area where the stored flows are treated and discharged. The number of storage basins

TABLE 7.9

EXAMPLE BEST MANAGEMENT PRACTICES CALCULATIONS

Percent Runoff From Storm Sewered Impervious Area (ROCI)

$$\begin{aligned} \mathrm{ROCI} &= 0.9\ (\mathrm{SSI}/100)/\mathrm{ROCS} \\ &= 0.9\ (17.43/100)/0.28 = 0.56 \end{aligned}$$

Impervious Land Area in Storm Sewered Area (IMAR)

$$\begin{aligned} \mathrm{IMAR} &= \mathrm{LAND}\ (\mathrm{SSI}/100) \\ &= 5448\ (17.43/100) = 950 \text{ acres} \end{aligned}$$

Curb Miles in Storm Sewered Area

$$\begin{aligned} \mathrm{CM} &= \mathrm{LAND}\ [0.0782-0.0668(0.839^{\mathrm{PDSS}})] \\ &= 5448\ [0.0782 - 0.0668(0.839^{2.93})] \\ \mathrm{CM} &= 208.45 \text{ mi.} \end{aligned}$$

Street Miles in Storm Sewered Area

$$\begin{aligned} \mathrm{SM} &= \mathrm{CM}/2 \\ &= 208.45/2 = 104.22 \text{ mi.} \end{aligned}$$

Percent Impervious Area Due to Streets (SAR)

$$\begin{aligned} \mathrm{SAR} &= [\mathrm{SM}(5280)34]/[43560(\mathrm{IMAR})] \\ &= [104.22(5280)34]/[43560(950)] \\ &= 0.452 \end{aligned}$$

Percent of Runoff Due to Streets (PRDS)

$$\begin{aligned} \mathrm{PRDS} &= \mathrm{SAR}\ \ (\mathrm{ROCI}) \\ &= 0.452\ \ (0.56) = 0.25 \end{aligned}$$

Percent Pollutants Removed by Sweeping (PPRS)

$$\begin{aligned} \mathrm{PPRS} &= [0.55(2)[\mathrm{PRDS}] / [1+\mathrm{PRDS}] \\ &= [0.55(2)0.25]/[1+0.25] \\ &= 0.22 \end{aligned}$$

for combined sewer overflow treatment is based on the average drainage area per combined sewer overflow. These values were published state-by-state in the APWA 1967 Survey[5]. Pumping rates from storage to consolidated treatment plants are calculated such that the volume of storage basins will be treated in the average time between storms. The equations for these calculations are:

$$\mathrm{NSP} = \mathrm{CSA}/\mathrm{ASCO} \tag{7.26}$$

$$\mathrm{STCS} = \mathrm{DVCS}/\mathrm{NSP} \tag{7.27}$$

$$\mathrm{TRCS} = \mathrm{STCS}/(365/\mathrm{MNS}) \tag{7.28}$$

where:

NSP = number of combined sewer storage facilities rounded up to avoid fractional plants

CSA = area served by combined sewers in acres, and

ASCO = average area served by each combined sewer overflow in acres

DVCS = volume of runoff from combined sewered area in million gallons

STCS = storage volume for each combined sewer overflow storage facility in million gallons

MNS = mean number of rainstorms each year, and

TRCS = discharge rate from storage for each combined sewer overflow storage facility in mgd.

The number and flowrates of consolidated treatment plants in each urbanized area is estimated by the following equations:

$$\mathrm{NTP} = (\mathrm{CSA}/1000)^{0.435} \tag{7.29}$$

$$\mathrm{CTR} = \mathrm{DVCS}/\mathrm{NTP}(365/\mathrm{MNS}) \tag{7.30}$$

where:

NTP = number of consolidated combined sewer overflow treatment plants in each urbanized area, rounded up such that fractional plants do not exist.

CTR = consolidated treatment rate in mgd.

The length of interceptors required in each urbanized area to transport flows from each storage facility to consolidated treatment plants is estimated based on the following equation developed from analysis of Chicago, Illinois data:

$$IL = 2.8876\ CSA \qquad (7.31)$$

where:

IL = Interceptor Length in feet

CSA = area served by combined sewers in acres

The equation to estimate the cost of these interceptors was developed based on information in the "Guidelines for 1976 Update of Needs for Municipal Wastewater Facilities"[18]. The equation is:

$$IC = 28.0\ TRCS^{0.30} \qquad (7.32)$$

where:

IC = Interceptor Cost in dollars per linear foot including all appurtenances

$TRCS$ = Discharge rate from each combined sewer overflow storage facility in mgd.

Capital and operation and maintenance costs for both storage facilities and consolidated treatment plants were determined based on the cost equations presented in Section 3.

Due to a lack of other nationwide information, storage volumes and treatment rates for storm sewer discharges are based on treating runoff from the average combined sewer overflow drainage area at each treatment plant. Treatment rates are calculated such that the volume of storage basins will be treated in the average time between storms. The equations for these calculations are:

$$\mathrm{NSSTP} = \mathrm{LAND/ASCO} \tag{7.33}$$

where:

NSSTP = number of storm sewer discharge treatment plants rounded up to avoid fractional plants

LAND = area served by storm sewers in acres

ASCO = average area served by each combined sewer overflow in acres

and:

$$\mathrm{SPTP} = \mathrm{DVSS/NSSTP} \tag{7.34}$$

$$\mathrm{TRSS} = \mathrm{SPTP/(365/MNS)} \tag{7.35}$$

where:

DVSS = volume of runoff from storm sewered area in million gallons

SPTP = storage volume for each storm sewer discharge treatment plant in million gallons

MNS = mean number of rainstorms each year, and

TRSS = treatment rate for each storm sewer discharge treatment plant in mgd.

Example calculations are shown in Table 7.10. No costs for collection or interceptor sewers to transport storm sewer discharges to treatment plant sites are included since these costs are not directly attributable to water quality control and should be highly variable between urbanized areas. When required, collection costs are dependent on the existing collection system, the availability of land, soil conditions, land slope, and many other localized factors.

TABLE 7.10

EXAMPLE COST CALCULATIONS

CATEGORY V

Number of Consolidated Combined Sewer Overflow Treatment Plants (NTP)

$NTP = (CSA/1000)^{0.435}$
$= (14{,}200/1000)^{0.435} = 4$

Consolidated Treatment Rate (CTR)

$CTR = DVCS/NTP(365/MNS)$
$= 70.53/4(365/92.67) = 4.48$ mgd

Number of Combined Sewer Storage Facilities (NSP)

$NSP = CSA/ASCO$
$= 14{,}200/415 = 35$

Storage per Combined Sewer Storage Facility (STCS)

$STCS = DVCS/NSP$
$= 70.53/35 = 2.02$ MG

Discharge Rate from Combined Sewer Storage Facility (TRCS)

$TRCS = STCS/(365/MNS)$
$= 2.02/(365/92.67) = 0.51$ mgd

Interceptor Length (IL)

$IL = 2.8875\,(CSA)$
$= 2.8875\,(14{,}200) = 41{,}002$ feet

CATEGORY VI

Number of Storm Sewer Treatment Plants (NSSTP)

$NSSTP = LAND/ASCO$
$= 5{,}448/415 = 14$

Storage per Storm Sewer Treatment Plant (SPTP)

$SPTP = DVSS/NSSTP$
$= 24.44/14 = 1.75$ MG

Treatment Rate of Storm Sewer Treatment Plant (TRSS)

$TRSS = SPTP/(365/MNS)$
$= 1.75/(365/92.67) = 0.44$ mgd

1990 Urbanized Area Population (POP_{90})

$POP_{90} = UAP\,(SMSA_{90} / SMSA_{70})\,(STATE_{EPA}/STATE_{OBERS})$

$= 75{,}940(5{,}488{,}000/5{,}438{,}000)(89{,}300/87{,}205)$
$= 78{,}480$

TABLE 7.10 (Cont'd)

EXAMPLE COST CALCULATIONS

1990 Population in the Storm Sewered Area (POPGA)

$\mathrm{POPGA} = \mathrm{POP}_{90} - \mathrm{CSAP}$

$= 78{,}480 - 60{,}000 = 18{,}480$

Urbanized Area 1990 Storm Sewer Land Area (UA_{90})

$\mathrm{UA}_{90} = \mathrm{POPGA}/\mathrm{PDSS}$

$= 18{,}480/2.93 = 6{,}307$ acres

Growth in Urbanized Area Land Area (UAG)

$\mathrm{UAG} = \mathrm{UA}_{90} - \mathrm{LAND}$

$= 6{,}307 - 5{,}448 = 859$ Acres

Design Volume For The Growth Area (DVGA)

$\mathrm{DVGA} = \mathrm{DS}(\mathrm{ROCS})\ \mathrm{UAG}\ (0.027158)$

$= 0.59\ (0.28) 859 (0.027158)$

$= 3.85$ MG

For the Aesthetics Criteria the cost equations associated with $\mathrm{LEVEL}_{\mathrm{CSO}} = 1$ and $\mathrm{LEVEL}_{\mathrm{SSA}} = 1$ and identified in Tables 3.2 and 3.3 were utilized to obtain the following costs.

Capital Costs for Treatment of Combined Sewer Overflows ($\mathrm{COST}_{\mathrm{CSO,CAP}}$)

$\mathrm{COST}_{\mathrm{CSO,CAP}} = \$16{,}781{,}068$

O&M Costs for Treatment of Combined Sewer Overflows ($\mathrm{COST}_{\mathrm{CSO,O\&M}}$)

$\mathrm{COST}_{\mathrm{CSO,O\&M}} = \$488{,}174$

Capital Costs for Treatment of Present Storm Sewer Flow ($\mathrm{COST}_{\mathrm{SSA,CAP,PRESENT}}$)

$\mathrm{COST}_{\mathrm{SSA,CAP,PRESENT}} = \$187{,}800$

Capital Costs for Treatment of 1990 Storm Sewer Flow ($\mathrm{COST}_{\mathrm{SSA,CAP,1990}}$)

$\mathrm{COST}_{\mathrm{SSA,CAP,1990}} = \$2{,}112{,}800$

O&M Costs for Treatment of Storm Sewer Flow ($\mathrm{COST}_{\mathrm{SSA,O\&M}}$)

$\mathrm{COST}_{\mathrm{SSA,O\&M}} = \$380{,}430$

TABLE 7.10 (Cont'd)

EXAMPLE COST CALCULATIONS

For the Fish and Wildlife Criteria the Costs are computed using $LEVEL_{CSO} = 2$ and $LEVEL_{SSA} = 1$, derived from Tables 3.2 and 3.4.

$COST_{CSO,CAP} = \$ 33,364,300$
$COST_{CSO,O\&M} = \$ 463,073$
$COST_{SSA,CAP,PRESENT} = \$ 187,800$
$COST_{SSA,CAP,1990} = \$2,112,800$
$COST_{SSA,O\&M} = \$380,430$

For the Recreation Criteria the additional Cost of Disinfection is added to the costs for the Fish and Wildlife Criteria.

$COST_{CSO,CAP} = \$ 33,399,600$
$COST_{CSO,O\&M} = \$495,845$
$COST_{SSA,CAP,PRESENT} = \$187,800$
$COST_{SSA,CAP,1990} = \$2,112,800$
$COST_{SSA,O\&M} = \$380,430$

These costs are then adjusted using the EPA Cost Index listed in Appendix B.

Section 8

NEEDS FOR CONTROL OF COMBINED SEWER OVERFLOWS

Needs reported for Category V - Control of Combined Sewer Overflows are to prevent periodic bypassing of untreated wastes from combined sewers to an extent such that water quality criteria are maintained. The Needs Estimation Model for Urban Runoff (NEMUR) provides cost estimates for control of combined sewer overflows in all urbanized areas to achieve each of three water quality criteria. The model estimates costs for each of 320 urbanized areas based on a consistent methodology as defined in Section 7 and sums these estimates to provide a state-by-state needs assessment.

8.1 CATEGORY V COST SUMMARY

The three Category V estimates required by the scope of this study are: (1) current year capital cost, (2) 1990 capital costs, and (3) annual equivalent operation, maintenance and repair costs for a 20-year planning period. An assumption was made that no combined sewers would be constructed between the present and 1990. Considering this assumption and since current and 1990 cost estimates are in January, 1976 dollars, there is no difference in the current and 1990 cost estimates for Category V. Category V needs estimates for each of the three water quality criteria in each state and each state's percentage of total national needs are shown on Table 8.1 through 8.3.

Two adjustments of the model reported cost estimates are required to obtain the final Category V needs. The combined sewered areas of municipalities outside urbanized area must be considered, and since the methodology assumes that there is presently no treatment or control of combined sewer overflows, the funds previously spent for combined sewer control facilities should be subtracted from the needs estimate.

8.2 NON-URBANIZED COMBINED SEWER CONTROL NEEDS

The area and population served by combined sewers outside of defined urbanized areas hereafter referred to as the non-urbanized combined sewered area was obtained from an American Public Works Administration report prepared for EPA[2]. This report was also used to define the combined sewered areas in each urbanized area.

The non-urbanized combined sewered area is located in numerous small communities on many different receiving waters. Therefore, it was impractical to utilize the NEMUR methodology based on receiving water characteristics for estimating the non-urbanized Category V needs. It was assumed that the average required cost of combined sewer control per acre in the urbanized area of each state would also apply to the non-urbanized combined sewered area of the same state. Where there is no

TABLE 8.1
STATE CATEGORY V (COMBINED SEWER) NEEDS TO ACHIEVE AESTHETICS WATER QUALITY CRITERIA
(Millions of Jan. 1976 Dollars)

STATE	CURRENT AND 1990 CAPITAL COSTS				PERCENTAGE OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
	URBANIZED AREA NEEDS	NEEDS FOR NON-URBANIZED AREAS	NEEDS MET BEFORE 1976	TOTAL ESTIMATED NEEDS		
ALABAMA	0.000	0.000	0.000	0.000	0.000	0.000
ALASKA	0.000	0.890	0.000	0.890	0.016	0.020
ARIZONA	0.000	0.000	0.000	0.000	0.000	0.000
ARKANSAS	4.216	7.058	0.000	11.274	0.202	0.182
CALIFORNIA	103.404	14.166	12.339	105.231	1.884	1.833
COLORADO	1.562	0.312	0.000	1.874	0.034	0.078
CONNECTICUT	141.657	20.824	3.539	158.942	2.845	4.415
DELAWARE	26.606	1.157	0.000	27.763	0.497	0.881
DIST.OF COL.	44.944	0.000	0.000	44.944	0.805	1.269
FLORIDA	0.000	0.151	0.000	0.151	0.003	0.003
GEORGIA	62.520	28.609	0.000	91.129	1.631	1.720
HAWAII	0.000	0.000	0.000	0.000	0.000	0.000
IDAHO	0.000	2.505	0.000	2.505	0.045	0.083
ILLINOIS	706.775	173.160	96.526	783.409	14.024	22.619
INDIANA	304.312	62.993	4.313	362.992	6.499	9.878
IOWA	11.995	12.832	0.000	24.827	0.444	0.662
KANSAS	25.482	23.769	0.000	49.251	0.882	1.327
KENTUCKY	28.434	19.455	0.000	47.889	0.857	2.122
LOUISIANA	0.000	0.000	0.000	0.000	0.000	0.000
MAINE	69.290	85.954	2.625	152.619	2.732	6.329
MARYLAND	0.546	10.520	0.000	11.066	0.198	0.588
MASSACHUSETTS	265.695	27.048	57.111	235.632	4.218	8.987
MICHIGAN	394.280	57.585	72.044	379.821	6.800	11.565
MINNESOTA	51.887	20.047	0.000	71.934	1.288	2.518
MISSISSIPPI	0.000	0.000	0.000	0.000	0.000	0.000
MISSOURI	343.043	35.903	0.000	378.946	6.784	8.982
MONTANA	0.000	0.000	0.000	0.000	0.000	0.000
NEBRASKA	26.032	10.837	0.000	36.869	0.660	0.599
NEVADA	3.907	0.651	0.000	4.558	0.082	0.198
NEW HAMPSHIRE	38.057	63.642	14.179	87.520	1.567	3.829
NEW JERSEY	190.607	0.000	0.000	190.607	3.412	5.733
NEW MEXICO	0.000	0.000	0.000	0.000	0.000	0.000
NEW YORK	742.756	83.735	38.021	788.470	14.116	23.083
NORTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
NORTH DAKOTA	0.704	8.078	0.686	8.096	0.145	0.574
OHIO	502.604	84.695	5.105	582.194	10.423	24.129
OKLAHOMA	0.000	0.000	0.000	0.000	0.000	0.000
OREGON	46.099	15.430	0.000	61.529	1.102	1.536
PENNSYLVANIA	251.164	32.747	0.000	283.911	5.083	11.083
RHODE ISLAND	85.819	2.735	10.155	78.399	1.404	3.418
SOUTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
SOUTH DAKOTA	0.401	12.785	1.216	11.970	0.214	0.518
TENNESSEE	35.224	18.024	0.000	53.248	0.953	1.391
TEXAS	10.046	2.763	0.000	12.809	0.229	0.300
UTAH	0.000	0.000	0.000	0.000	0.000	0.000
VERMONT	0.000	51.111	0.191	50.920	0.912	1.924
VIRGINIA	71.330	0.000	0.000	71.330	1.277	2.632
WASHINGTON	72.961	6.475	0.000	79.436	1.422	2.450
WEST VIRGINIA	90.230	27.739	0.000	117.969	2.112	8.676
WISCONSIN	73.002	58.686	14.220	117.468	2.103	5.237
WYOMING	0.000	0.000	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000	0.000	0.000
PUERTO RICO	5.369	0.000	0.000	5.369	0.096	0.102
VIRGIN ISLANDS	0.000	0.000	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000	0.000	0.000
PAC.TR.TERR.	0.000	0.000	0.000	0.000	0.000	0.000
U.S. TOTALS	4,832.937	1,085.071	332.270	5,585.761	100.000	183.369

[1] Sum of entries may not equal totals due to round-off.

TABLE 8.2
STATE CATEGORY V (COMBINED SEWER) NEEDS TO ACHEIVE THE FISH & WILDLIFE WATER QUALITY CRITERIA
(Millions of January 1976 Dollars)

STATE	PRESENT AND 1990 CAPITAL COSTS				PERCENTAGE OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
	URBANIZED AREA NEEDS	NEEDS FOR OTHER AREAS	NEEDS MET BEFORE 1976	TOTAL ESTIMATED NEEDS		
ALABAMA	0.000	0.000	0.000	0.000	0.000	0.000
ALASKA	0.000	2.046	0.000	2.046	0.017	0.030
ARIZONA	0.000	0.000	0.000	0.000	0.000	0.000
ARKANSAS	11.119	18.613	0.000	29.732	0.246	0.425
CALIFORNIA	237.366	32.519	12.339	257.546	2.131	2.666
COLORADO	1.562	0.312	0.000	1.874	0.016	0.078
CONNECTICUT	234.218	34.430	3.539	265.648	2.198	4.794
DELAWARE	26.606	1.157	0.000	27.763	0.230	0.881
DIST. OF COLUM.	101.723	0.000	0.000	101.723	0.842	1.265
FLORIDA	0.000	0.328	0.000	0.328	0.003	0.004
GEORGIA	135.532	62.019	0.000	197.551	1.634	2.651
HAWAII	0.000	0.000	0.000	0.000	0.000	0.000
IDAHO	0.000	5.697	0.000	5.697	0.047	0.098
ILLINOIS	1458.561	357.347	96.526	1719.382	14.223	22.800
INDIANA	686.060	142.014	4.313	823.761	6.814	10.346
IOWA	29.137	31.171	0.000	60.308	0.499	0.708
KANSAS	37.702	35.165	0.000	72.867	0.603	1.314
KENTUCKY	52.429	35.872	0.000	88.301	0.731	1.566
LOUISIANA	0.000	0.000	0.000	0.000	0.000	0.000
MAINE	146.601	181.859	2.625	325.835	2.695	4.761
MARYLAND	1.514	30.280	0.000	31.794	0.263	1.155
MASSACHUSETTS	570.957	58.123	57.111	571.969	4.731	8.228
MICHIGAN	828.769	121.042	72.044	877.767	7.261	12.430
MINNESOTA	113.265	43.761	0.000	157.026	1.299	2.089
MISSISSIPPI	0.000	0.000	0.000	0.000	0.000	0.000
MISSOURI	779.388	81.571	0.000	860.959	7.122	8.792
MONTANA	0.000	0.000	0.000	0.000	0.000	0.000
NEBRASKA	68.681	28.592	0.000	97.273	0.805	0.957
NEVADA	8.325	1.387	0.000	9.712	0.080	0.117
NEW HAMPSHIRE	83.955	140.373	14.179	210.149	1.739	3.113
NEW JERSEY	413.490	0.000	0.000	413.490	3.420	5.263
NEW MEXICO	0.000	0.000	0.000	0.000	0.000	0.000
NEW YORK	1558.825	275.647	38.021	1796.451	14.861	24.469
NORTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
NORTH DAKOTA	0.704	8.078	0.686	8.096	0.067	0.574
OHIO	1037.696	174.915	5.105	1207.506	9.989	18.152
OKLAHOMA	0.000	0.000	0.000	0.000	0.000	0.000
OREGON	104.845	35.093	0.000	139.939	1.158	1.797
PENNSYLVANIA	377.801	49.257	0.000	427.058	3.532	10.087
RHODE ISLAND	181.998	5.800	10.155	177.643	1.470	2.576
SOUTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
SOUTH DAKOTA	0.401	1.003	1.216	0.188	0.002	0.084
TENNESSEE	71.860	36.771	0.000	108.631	0.899	1.503
TEXAS	26.008	7.152	0.000	33.160	0.274	0.523
UTAH	0.000	0.000	0.000	0.000	0.000	0.000
VERMONT	0.000	112.752	0.191	112.561	0.931	1.565
VIRGINIA	150.907	13.698	0.000	164.605	1.362	2.200
WASHINGTON	167.740	63.773	0.000	231.513	1.915	3.355
WEST VIRGINIA	162.947	105.981	0.000	268.928	2.225	5.973
WISCONSIN	142.282	57.923	14.220	185.985	1.539	3.561
WYOMING	0.000	0.000	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000	0.000	0.000
PUERTO RICO	15.355	0.000	0.000	15.355	0.127	0.349
VIRGIN ISLANDS	0.000	0.000	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000	0.000	0.000
PAC. TR. TERR.	0.000	0.000	0.000	0.000	0.000	0.000
U.S. TOTAL[1]	10,026.293	2393.521	332.270	12,088.120	100.000	173.299

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[1] Sum of entries may not equal totals due to round off errors.

TABLE 8.3
STATE CATEGORY V (COMBINED SEWER) NEEDS TO ACHIEVE THE RECREATION CRITERIA
(Millions of Jan. 1976 Dollars)

STATE	CURRENT AND 1990 CAPITAL COSTS				PERCENTAGE OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
	URBANIZED AREA NEEDS	NEEDS FOR NON-URBANIZED AREAS	NEEDS MET BEFORE 1976	TOTAL ESTIMATED NEEDS		
ALABAMA	0.000	0.000	0.000	0.000	0.000	0.000
ALASKA	0.000	3.019	0.000	3.019	0.017	0.047
ARIZONA	0.000	0.000	0.000	0.000	0.000	0.000
ARKANSAS	17.509	29.310	0.000	46.819	0.256	0.752
CALIFORNIA	349.564	47.850	12.339	385.115	2.109	4.232
COLORADO	2.807	0.561	0.000	3.368	0.018	0.146
CONNECTICUT	340.764	50.092	3.539	387.317	2.121	6.585
DELAWARE	38.118	1.615	0.000	39.733	0.218	1.054
DIST. OF COLUM	149.297	0.000	0.000	149.297	0.818	1.913
FLORIDA	0.000	0.500	0.000	0.500	0.003	0.007
GEORGIA	206.659	94.567	0.000	301.226	1.649	4.084
HAWAII	0.000	0.000	0.000	0.000	0.000	0.000
IDAHO	0.000	8.569	0.000	8.569	0.047	0.153
ILLINOIS	2154.244	527.790	96.526	2585.508	14.158	33.960
INDIANA	1025.116	212.175	4.313	1232.978	6.752	15.236
IOWA	43.864	46.926	0.000	90.790	0.497	1.072
KANSAS	55.858	52.103	0.000	107.961	0.591	1.780
KENTUCKY	78.485	53.699	0.000	132.184	0.724	2.093
LOUISIANA	0.000	0.000	0.000	0.000	0.000	0.000
MAINE	216.624	268.246	2.625	482.245	2.641	6.773
MARYLAND	2.260	45.200	0.000	47.460	0.260	1.365
MASSACHUSETTS	847.050	86.230	57.111	876.169	4.798	12.179
MICHIGAN	1238.602	180.898	72.044	1347.456	7.379	18.792
MINNESOTA	161.139	62.258	0.000	223.397	1.223	2.899
MISSISSIPPI	0.000	0.000	0.000	0.000	0.000	0.000
MISSOURI	1169.700	122.421	0.000	1292.121	7.075	13.462
MONTANA	0.000	0.000	0.000	0.000	0.000	0.000
NEBRASKA	103.167	42.948	0.000	146.115	0.800	1.559
NEVADA	12.570	2.094	0.000	14.664	0.080	0.149
NEW HAMPSHIRE	120.561	201.578	14.179	307.960	1.686	4.037
NEW JERSEY	604.920	0.000	0.000	604.920	3.312	7.693
NEW MEXICO	0.000	0.000	0.000	0.000	0.000	0.000
NEW YORK	2295.529	405.918	38.021	2663.426	14.585	36.098
NORTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
NORTH DAKOTA	1.084	12.439	0.686	12.837	0.070	0.674
OHIO	1515.299	255.418	5.105	1765.612	9.668	25.500
OKLAHOMA	0.000	0.000	0.000	0.000	0.000	0.000
OREGON	157.698	52.783	0.000	210.481	1.153	2.811
PENNSYLVANIA	725.866	94.639	0.000	820.505	4.493	12.053
RHODE ISLAND	265.889	8.474	10.155	264.208	1.447	3.697
SOUTH CAROLINA	0.000	0.000	0.000	0.000	0.000	0.000
SOUTH DAKOTA	0.684	1.710	1.216	1.178	0.006	0.119
TENNESSEE	121.200	62.180	0.000	183.380	1.004	2.596
TEXAS	38.261	10.522	0.000	48.783	0.267	0.748
UTAH	0.000	0.000	0.000	0.000	0.000	0.000
VERMONT	0.000	161.913	0.191	161.722	0.886	2.029
VIRGINIA	224.563	20.384	0.000	244.947	1.341	3.172
WASHINGTON	247.456	94.080	0.000	341.536	1.870	5.026
WEST VIRGINIA	258.459	168.102	0.000	426.561	2.336	6.737
WISCONSIN	207.117	84.317	14.220	277.214	1.518	4.610
WYOMING	0.000	0.000	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000	0.000	0.000
PUERTO RICO	22.602	0.000	0.000	22.602	0.124	0.578
VIRGIN ISLANDS	0.000	0.000	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000	0.000	0.000
PAC.TR.TERR.	0.000	0.000	0.000	0.000	0.000	0.000
U.S. TOTALS[1]	15,020.527	3573.568	332.270	18,261.883	100.000	248.070

[1] Sum of entries may not equal totals due to round-off errors.

urbanized combined sewered area in a state which has non-urbanized combined sewered area, the average control cost per acre of the adjacent state is utilized to obtain cost estimates.

The non-urbanized combined sewer control needs are estimated on Tables 8.1 through 8.3 for each of the three water quality criteria. The non-urbanized acreage served by combined sewers in each state and the dollars/acre cost of combined sewer control for each water quality criteria in each state are listed in Table 8.4. The non-urbanized combined sewer control needs are approximately 20 percent of the total national needs for combined sewer control.

8.3 PREVIOUSLY MET NEEDS

The amount of funds previously spent for combined sewer control was determined based on EPA grant records. The Grants Information Control System was queried to obtain information on all combined sewer control projects funded prior to January 1, 1976. A total of 46 projects in 17 states were identified and the total eligible cost for water quality control was $332.270 million. These costs are subtracted from the state needs estimate to obtain the total 1976 estimated needs for each state. Previously met needs are itemized on Tables 8.1 through 8.3.

8.4 COMPARISON OF CATEGORY V NEEDS SURVEYS

The total national combined sewer needs estimate for each water quality criteria and the 1973 and 1974 Needs Survey estimates for Category V are shown on Table 8.5. The costs estimated in 1976 are 42 percent of those reported in the 1974 Needs Survey and 102 percent of those in the 1973 Needs Survey after adjusting the earlier needs surveys to January 1976 dollars. The primary reasons for this significant decrease in the needs estimate are as follows:

- The 1973 needs estimates were developed independently by the states with a minimum of specific guidance from EPA. Therefore, there was no consistent methodology with regard to cost-sensitive parameters such as design storm size, effluent limitations or cost estimating equations. More guidance was available for the 1974 Needs Survey.

- The 1976 needs estimate considers the capability of receiving waters to assimilate wastewater discharges from combined sewer overflows. In the 1976 survey a mix of control technologies, including BMP's, was used which generally led to lower levels of required combined sewer control than those which were utilized in 1974.

- The 1976 needs estimates are based on a concept of treating all of a relatively small design storm and the first flush of all larger storms. This consideration

TABLE 8.4
NON-URBANIZED COMBINED SEWERED AREAS AND AVERAGE DOLLARS/ACRE CONTROL COST

STATE	COMBINED SEWERED ACREAGE OUTSIDE URBANIZED AREAS	DOLLARS/ACRE CAPITAL COST - CATEGORY V		
		AESTHETICS CRITERIA	FISH & WILDLIFE CRITERIA	RECREATION CRITERIA
ALABAMA	0	-	-	-
ALASKA	700	1,272	2,925	4,316
ARIZONA	0	-	-	-
ARKANSAS	7,200	980	2,585	4,071
CALIFORNIA	7,400	1,914	4,394	6,472
COLORADO	300	1,040	1,040	1,870
CONNECTICUT	6,600	3,155	5,217	7,590
DELAWARE	400	2,892	2,892	4,038
DISTRICT OF COLUM.	0	-	-	-
FLORIDA	100	1,514	3,280	5,003
GEORGIA	18,900	1,514	3,280	5,003
HAWAII	0	-	-	-
IDAHO	1,315	1,905	4,332	6,516
ILLINOIS	72,000	2,405	4,963	7,330
INDIANA	28,100	2,242	5,054	7,551
IOWA	4,600	2,790	6,776	10,201
KANSAS	11,100	2,141	3,168	4,694
KENTUCKY	3,900	4,988	9,198	13,769
LOUISIANA	0	-	-	-
MAINE	29,400	2,924	6,186	9,124
MARYLAND	4,000	2,630	7,570	11,300
MASSACHUSETTS	9,600	2,818	6,054	8,982
MICHIGAN	33,300	1,729	3,635	5,432
MINNESOTA	11,900	1,685	3,677	5,232
MISSISSIPPI	0	-	-	-
MISSOURI	15,500	2,316	5.263	7,898
MONTANNA	0	-	-	-
NEBRASKA	8,700	1,246	3,286	4,937
NEVADA	400	1,628	3,468	5,235
NEW HAMPSHIRE	19,900	3,198	7,054	10,130
NEW JERSEY	0	-	-	-
NEW MEXICO	0	-	-	-
NEW YORK	34,500	2,427	7,990	11,766
NORTH CAROLINA	0	-	-	-
NORTH DAKOTA	4,590	1,760	1,760	2,710
OHIO	32,500	2,606	5,382	7,859
OKLAHOMA	0	-	-	-
OREGON	8,100	1,905	4,332	6,516
PENNSYLVANIA	10,300	3,179	4,782	9,188
RHODE ISLAND	800	3,419	7,250	10,592
SOUTH CAROLINA	0	-	-	-
SOUTH DAKOTA	500	2,006	2,006	3,420
TENNESSEE	8,700	2,072	4,227	7,147
TEXAS	1,100	2,512	6,502	9,565
UTAH	0	-	-	-
VERMONT	15,980	3,198	7,054	10,130
VIRGINIA	2,124	3,048	6,449	9,597
WASHINGTON	21,800	1,272	2,925	4,316
WEST VIRGINIA	22,700	2,585	4,669	7,405
WISCONSIN	9,200	3,230	6,296	9,165
WYOMING	0	-	-	-
MINIMUM		980	1,040	1,870
MAXIMUM		4,988	9,198	13,769
AVERAGE		2,371	5,164	7,710

TABLE 8.5

COMPARISON OF CATEGORY V NEEDS ESTIMATES

Category V Needs Estimates	Total National Needs (Millions of January, 1976 Dollars)
1976 Needs Survey	
Aesthetics Water Quality Criteria	5,586
Fish & Wildlife Water Quality Criteria	12,088
Recreation Water Quality Criteria	18,262
1974 Needs Survey	43,506
1973 Needs Survey	17,776

generally leads to smaller treatment facilities than those identified in 1974.

Conveyance systems costs were included in the 1974 Survey to a much greater extent due to the use of sewer separation as a control technology.

Based on these considerations, it is our belief that the 1976 Needs Survey provides a more uniform estimate of the eligible costs for water quality control and a consistent basis of comparison of relative needs among the states.

8.5 RELIABILITY OF CATEGORY V RESULTS

Due to the large number of assumptions which were required to develop a systematic nationwide methodology, the minimum available data base defining the extent of combined sewers, and the small technology base for the treatment of combined sewer overflows, the cost estimates should be considered only as a best estimate. Also, only a small amount of site specific data is available. Therefore, the individual urbanized area needs should be used with care. The relationship between total state needs and the total national amount provides an equitable distribution of funds for water quality control of combined sewer overflows.

Section 9

NEEDS FOR CONTROL OF STORMWATER DISCHARGES

Costs reported for Category VI are to provide control and/or treatment of urban stormwater runoff channeled through sewers and other conveyances used only for such runoff such that water quality criteria are maintained. As in Category V, the Needs Estimation Model for Urban Runoff (NEMUR) provides cost estimates for control of stormwater discharges in all urbanized areas to achieve each of three water quality criteria.

9.1 CATEGORY VI COST SUMMARY

Three Category VI estimates are required: (1) current capital costs, (2) 1990 capital costs, and (3) annual equivalent operation, maintenance and repair costs for a 20-year planning period. Estimates for each of 320 urbanized areas are summed to provide a state-by-state and national needs assessment. The state Category VI needs estimates for each of the three water quality criteria are shown on Tables 9.1 through 9.3.

Costs to achieve the Aesthetics water quality criteria were estimated based on applying Best Management Practices to the area served by storm sewers in all urbanized areas. Best Management Practices were assumed to include effective street sweeping of all streets at a frequency of once per week; application of construction practices to four percent of the urbanized area each year; and construction of detention basins for the area of growth between the current year and 1990. Cost functions for these practices were itemized in Table 3.2. The current capital cost estimates, listed by state on Table 9.1, include the cost of street sweeping equipment; 1990 capital cost estimates include the cost of street sweeping equipment and detention basin construction; and operation and maintenance cost estimates include construction practices and the operation and maintenance required for street sweeping and detention basins. This assumed set of practices does not imply that they are the most effective or least costly pollutant control scheme, merely an assumed mix of control methods whose cost and effectiveness could be evaluated in a consistent manner nationwide. A particular municipality conducting Best Management Practices might decide to sweep heavily utilized streets more often, clean catch basins, or use other combinations of effective control schemes.

Costs to achieve the Fish and Wildlife water quality criteria were estimated based on the assimiliative capacity of the receiving water in each urbanized area. Best Management Practices are assumed to be a minimum control level. Where these practices do not provide enough pollutant removal, structural control systems similar to those evaluated for combined sewers are sized to treat the stormwater runoff from the urbanized area. Cost estimates are listed by state on Table 9.2 for the Fish and Wildlife water quality criteria.

TABLE 9.1
STATE CATEGORY VI (STORMWATER) NEEDS TO ACHIEVE THE AESTHETICS WATER QUALITY CRITERIA
(Millions of Jan. 1976 Dollars)

STATE	CURRENT CAPITAL COSTS	1990 CAPITAL COSTS	PERCENT OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
ALABAMA	13.937	224.733	1.098	15.850
ALASKA	1.297	15.202	0.074	1.413
ARIZONA	12.934	523.084	2.555	22.315
ARKANSAS	4.151	116.067	0.567	5.731
CALIFORNIA	128.358	3036.656	14.833	151.401
COLORADO	10.990	174.078	0.850	11.764
CONNECTICUT	24.111	604.849	2.955	32.980
DELAWARE	2.879	93.327	0.456	4.177
DIST. OF COLUM.	1.736	114.784	0.561	3.696
FLORIDA	41.111	2593.454	12.669	87.012
GEORGIA	13.260	355.982	1.739	18.272
HAWAII	6.194	137.020	0.669	7.138
IDAHO	0.841	8.855	0.043	0.809
ILLINOIS	35.940	887.248	4.334	50.430
INDIANA	13.646	411.193	2.009	25.455
IOWA	9.849	134.712	0.658	11.112
KANSAS	6.233	124.876	0.610	7.227
KENTUCKY	9.530	152.933	0.747	9.765
LOUISIANA	10.992	226.572	1.107	11.975
MAINE	1.049	38.944	0.190	2.660
MARYLAND	19.220	359.383	1.756	19.542
MASSACHUSETTS	34.977	652.287	3.186	41.062
MICHIGAN	27.920	701.385	3.426	41.737
MINNESOTA	16.282	272.816	1.333	19.511
MISSISSIPPI	3.177	46.626	0.228	3.303
MISSOURI	14.465	515.075	2.516	26.325
MONTANTA	1.395	8.116	0.040	1.143
NEBRASKA	3.150	65.407	0.320	4.219
NEVADA	3.731	124.654	0.609	6.201
NEW HAMPSHIRE	1.170	102.873	0.503	3.795
NEW JERSEY	64.219	1015.406	4.960	73.617
NEW MEXICO	2.652	36.421	0.178	2.823
NEW YORK	33.723	810.211	3.958	43.740
NORTH CAROLINA	9.396	172.358	0.842	10.778
NORTH DAKOTA	0.397	2.032	0.010	0.310
OHIO	48.631	864.198	4.222	59.678
OKLAHOMA	10.693	238.930	1.167	16.641
OREGON	7.375	241.286	1.179	11.548
PENNSYLVANIA	56.786	542.703	2.651	51.043
RHODE ISLAND	4.719	86.938	0.425	5.862
SOUTH CAROLINA	4.989	84.411	0.412	5.512
SOUTH DAKOTA	0.663	5.405	0.026	0.581
TENNESSEE	15.364	293.854	1.435	18.089
TEXAS	61.217	2122.355	10.368	92.804
UTAH	6.811	100.178	0.489	7.476
VERMONT	0.000	0.000	0.000	0.000
VIRGINIA	21.848	431.039	2.106	25.840
WASHINGTON	15.601	224.918	1.099	18.143
WEST VIRGINIA	2.181	19.734	0.096	2.656
WISCONSIN	17.439	192.014	0.938	17.813
WYOMING	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000
PUERTO RICO	7.241	163.376	0.798	7.737
VIRGIN ISLANDS	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000
PAC.TR.TERR.	0.000	0.000	0.000	0.000
U.S. TOTALS[1]	866.464	20,470.871	100.000	1,118.506

[1] Sum of entries may not equal totals due to round-off.

TABLE 9.2
STATE CATEGORY VI (STORMWATER) NEEDS TO ACHIEVE THE FISH AND WILDLIFE WATER QUALITY CRITERIA
(Millions of Jan. 1976 Dollars)

STATE	CURRENT CAPITAL COSTS	1990 CAPITAL COSTS	PERCENT OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
ALABAMA	108.614	319.411	0.630	19.113
ALASKA	1.297	15.202	0.030	1.413
ARIZONA	12.934	523.084	1.032	22.315
ARKANSAS	4.151	116.067	0.229	5.731
CALIFORNIA	2268.985	5177.266	10.217	208.013
COLORADO	10.990	174.078	0.344	11.764
CONNECTICUT	808.813	1389.552	2.742	67.692
DELAWARE	2.879	93.327	0.184	4.177
DIST. OF COLUM.	1.736	114.784	0.227	3.696
FLORIDA	4775.707	7328.039	14.461	359.317
GEORGIA	135.363	478.085	0.943	22.742
HAWAII	291.964	422.790	0.834	19.928
IDAHO	0.841	8.855	0.017	0.809
ILLINOIS	1038.487	1889.797	3.729	144.166
INDIANA	326.545	724.093	1.429	49.626
IOWA	9.849	134.712	0.266	11.112
KANSAS	6.233	124.875	0.246	7.227
KENTUCKY	9.530	152.933	0.302	9.763
LOUISIANA	35.246	250.826	0.495	12.808
MAINE	72.256	110.151	0.217	10.006
MARYLAND	716.791	1056.953	2.086	62.686
MASSACHUSETTS	1626.558	2243.869	4.428	106.741
MICHIGAN	676.286	1349.752	2.664	66.773
MINNESOTA	704.928	961.462	1.897	51.620
MISSISSIPPI	148.406	191.855	0.379	9.492
MISSOURI	14.465	515.075	1.016	26.325
MONTANA	1.395	8.116	0.016	1.143
NEBRASKA	3.150	65.407	0.129	4.219
NEVADA	3.731	124.654	0.246	6.201
NEW HAMPSHIRE	24.996	126.699	0.250	4.999
NEW JERSEY	6165.676	7116.863	14.044	579.402
NEW MEXICO	2.652	36.421	0.072	2.823
NEW YORK	1260.087	2036.577	4.019	118.403
NORTH CAROLINA	9.396	172.358	0.340	10.778
NORTH DAKOTA	0.397	2.032	0.004	0.310
OHIO	3325.437	4141.000	8.172	372.198
OKLAHOMA	12.072	240.309	0.474	13.680
OREGON	7.375	241.286	0.476	11.548
PENNSYLVANIA	2289.106	2775.024	5.476	228.727
RHODE ISLAND	4.719	86.938	0.172	5.862
SOUTH CAROLINA	65.925	145.348	0.287	7.653
SOUTH DAKOTA	1.206	5.947	0.012	0.602
TENNESSEE	113.846	392.336	0.774	22.651
TEXAS	1338.646	3399.785	6.709	149.840
UTAH	59.970	153.338	0.303	13.297
VERMONT	0.000	0.000	0.000	0.000
VIRGINIA	1004.297	1413.489	2.789	103.977
WASHINGTON	35.075	244.392	0.482	19.134
WEST VIRGINIA	2.161	19.734	0.039	2.656
WISCONSIN	1372.321	1546.896	3.053	202.781
WYOMING	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000
PUERTO RICO	157.336	313.470	0.619	12.961
VIRGIN ISLANDS	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000
PAC.TR.TERR.	0.000	0.000	0.000	0.000
U.S. TOTALS[1]	31,070.754	50,675.234	100.000	3,180.900

[1] Sum of entries may not equal totals due to round-offs.

TABLE 9.3
STATE CATEGORY VI (STORMWATER) NEEDS TO ACHIEVE THE RECREATION WATER QUALITY CRITERIA
(Millions of Jan. 1976 Dollars)

STATE	CURRENT CAPITAL COSTS	1990 CAPITAL COSTS	PERCENT OF NATIONAL NEEDS	ANNUAL OPERATION AND MAINTENANCE COSTS
ALABAMA	113.466	324.263	0.599	19.412
ALASKA	1.297	15.202	0.028	1.413
ARIZONA	12.934	523.084	0.966	22.315
ARKANSAS	4.151	116.067	0.214	5.731
CALIFORNIA	2389.975	5298.258	9.788	212.136
COLORADO	10.990	174.078	0.322	11.764
CONNECTICUT	899.606	1480.345	2.735	69.635
DELAWARE	2.879	53.327	0.172	4.177
DIST. OF COLUM.	1.736	114.784	0.212	3.696
FLORIDA	5685.594	8237.926	15.218	370.545
GEORGIA	142.346	485.067	0.896	23.037
HAWAII	335.237	466.062	0.861	20.561
IDAHO	0.841	8.855	0.016	0.809
ILLINOIS	1144.551	1995.860	3.687	116.463
INDIANA	368.607	766.155	1.415	50.324
IOWA	9.849	134.712	0.249	11.112
KANSAS	6.233	124.876	0.231	7.227
KENTUCKY	9.530	152.933	0.283	9.765
LOUISIANA	36.195	251.775	0.465	12.869
MAINE	85.694	123.589	0.228	10.160
MARYLAND	788.091	1128.254	2.084	64.261
MASSACHUSETTS	1716.528	2333.839	4.311	106.272
MICHIGAN	656.929	1330.395	2.458	64.646
MINNESOTA	19.180	275.714	0.509	19.631
MISSISSIPPI	168.158	211.606	0.391	9.835
MISSOURI	14.465	515.075	0.952	26.325
MONTANA	1.395	8.116	0.015	1.143
NEBRASKA	3.150	65.407	0.121	4.219
NEVADA	3.731	124.654	0.230	6.201
NEW HAMPSHIRE	29.927	131.630	0.243	5.062
NEW JERSEY	7093.277	8044.465	14.861	592.902
NEW MEXICO	2.652	36.421	0.067	2.823
NEW YORK	1389.363	2155.852	4.001	121.378
NORTH CAROLINA	9.396	172.358	0.318	10.778
NORTH DAKOTA	0.397	2.032	0.004	0.310
OHIO	3936.619	4752.180	8.779	379.664
OKLAHOMA	12.134	240.391	0.444	13.604
OREGON	7.375	241.286	0.446	11.548
PENNSYLVANIA	2611.604	3097.523	5.722	233.825
RHODE ISLAND	4.719	86.938	0.161	5.862
SOUTH CAROLINA	68.701	148.124	0.274	7.811
SOUTH DAKOTA	1.282	6.026	0.011	0.603
TENNESSEE	126.777	405.266	0.749	22.927
TEXAS	1446.796	3507.936	6.480	152.688
UTAH	70.784	164.151	0.303	13.401
VERMONT	0.000	0.000	0.000	0.000
VIRGINIA	1141.297	1550.490	2.864	106.132
WASHINGTON	39.210	248.527	0.459	19.183
WEST VIRGINIA	2.181	19.734	0.036	2.656
WISCONSIN	1737.234	1911.808	3.532	205.608
WYOMING	0.000	0.000	0.000	0.000
GUAM	0.000	0.000	0.000	0.000
PUERTO RICO	163.149	319.284	0.590	13.404
VIRGIN ISLANDS	0.000	0.000	0.000	0.000
AMERICAN SAMOA	0.000	0.000	0.000	0.000
PAC. TR. TERR.	0.000	0.000	0.000	0.000
U.S. TOTALS[1]	38,528.152	54,132.[illegible]	100.000	3,207.932

[1] Sum of entries may not equal totals due to round-offs.

Cost estimates for the Recreation water quality criteria included disinfection of effluents from all structural treatment systems. Otherwise, treatment and/or control levels were the same as those evaluated for the Fish and Wildlife water quality criteria. Cost estimates for the Recreation water quality criteria are listed on Table 9.3.

9.2 COMPARISON OF CATEGORY VI NEEDS SURVEYS

The total national stormwater needs estimate for each water quality criteria and the sum of 1974 state needs estimates for Category VI are shown on Table 9.4. The costs estimated in 1976 are significantly less than those reported in the 1974 Needs Survey. The primary reasons for this significant decrease in the needs estimate are as follows:

- The 1974 needs estimates were developed independently by the states with a minimum of specific guidance from EPA. Therefore, there were widely varying methodologies between the states with no uniform estimating procedure.
- Since there was no guidance or regulations defining the area requiring stormwater control, many states used population minimums to define urban stormwater runoff. These population minimums ranged from 500 to 25,000, all giving a significantly larger area requiring stormwater control than the urbanized area definition used in the 1976 Needs Survey.
- Large design storms, up to an intensity of 3 inches per hour, and a frequency-duration of 15-year-24 hour, were used to size storage and treatment systems. Comparatively a relatively small design storm with a high recurrence interval is used in the present survey.
- Collection costs included in the 1974 Needs Survey ranged from $328 to $8,000 per acre. Collection costs are not included in the 1976 results.
- The assimilative capacity of receiving waters is considered in the 1976 Needs Survey. This generally leads to much lower levels of stormwater control than those utilized in 1974.

Based on these considerations, the 1976 Needs Survey - Category VI estimates appear to provide a more equitable distribution of needs between states due to the consistent methodology utilized.

9.3 RELIABILITY OF CATEGORY VI RESULTS

Since the technology base related to the control and/or treatment

TABLE 9.4

COMPARISON OF 1976 AND 1974 CATEGORY VI NEEDS ESTIMATES

Needs Estimates	Total National Needs (Millions of January 1976 Dollars)
1976 Needs Survey	
Aesthetics Water Quality Criteria	20,471
Fish & Wildlife Water Quality Criteria	50,675
Recreation Water Quality Criteria	54,133
1974 Needs Survey	329,008

of stormwater runoff is minimal, and many assumptions are required to develop the cost estimates, they should only be considered as rough estimates. The needs survey results are only as accurate as the assumptions upon which they are based. The effectiveness of streetsweeping technology applied in an intensive streetsweeping program on receiving water quality is not well known. The accuracy of the suspended solids water quality criteria is also not well known. All needs estimates should be used with care. The estimating methodology was an effort to develop state-by-state and national estimates and may be of limited value in any specific urbanized area.

PART III

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APPENDIX A

STUDY SITE DATA

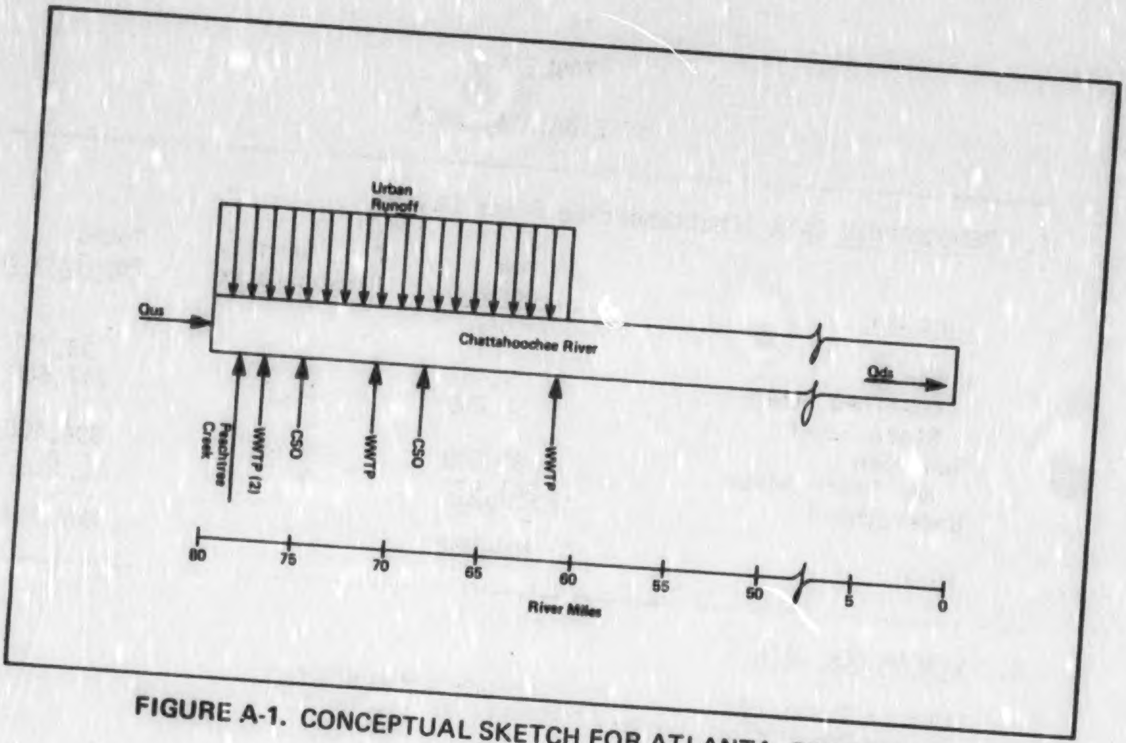

Urban Runoff
Qus
Chattahoochee River
Qds
Peachtree Creek
WWTP (2)
CSO
WWTP
CSO
WWTP
80
75
70
65
60
55
50
5
0
River Miles

FIGURE A-1. CONCEPTUAL SKETCH FOR ATLANTA, GEORGIA.

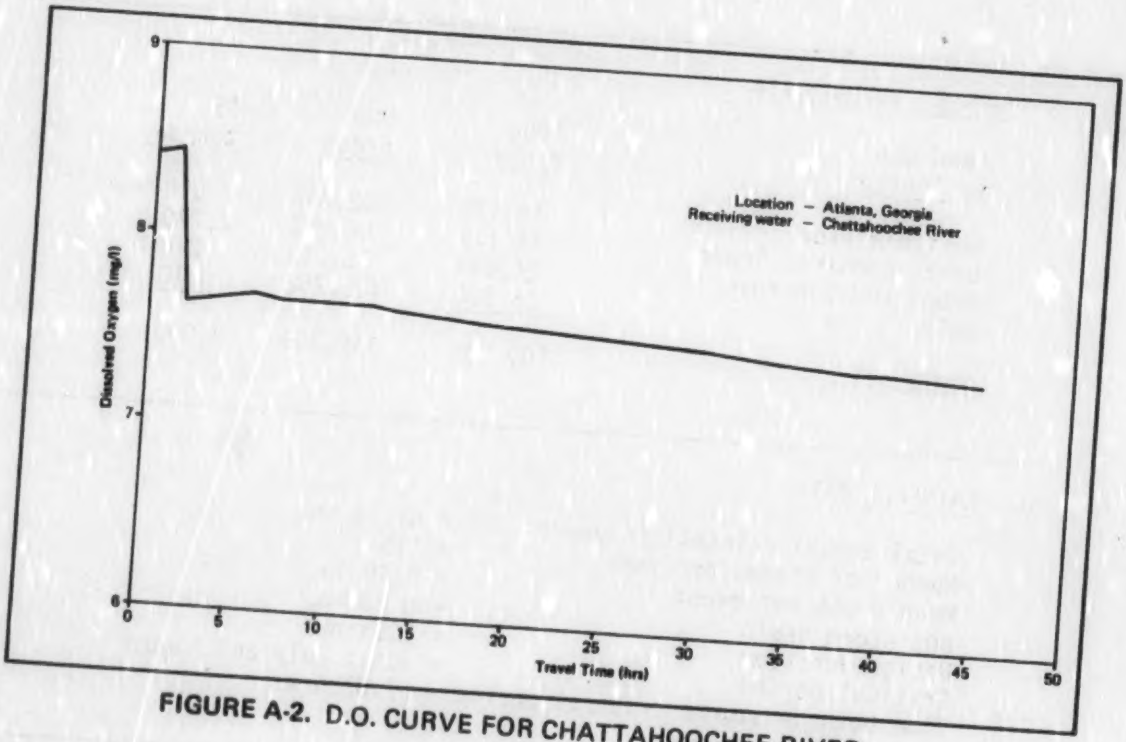


FIGURE A-2. D.O. CURVE FOR CHATTAHOOCHEE RIVER.

TABLE A-1

SITE DATA ATLANTA

A. DEMOGRAPHIC DATA (Chattahoochee River Basin)

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	9,062	3.72	33,711
Storm Sewer	51,200	4.25	217,600
Suburban			
Non Storm Sewer	92,800	4.25	394,400
Undeveloped	241,920	0	0
TOTAL	394,982		645,711

B. STREAMFLOW DATA

Qus = 2,499 cfs Qds = 4,708 cfs
Temp = 18.0° C - upstream
23.0° C - downstream
DO = 8.4 mg/l
K_2 = 1.5 - downstream

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	18,176	102,863	510
Urban Combined Sewer	44,179	94,542	2,270
Urban and Suburban	21,944	36,212	210
WWTP	25,520	125,752	10
TOTAL	109,819	359,369	3,000

D. RAINFALL DATA

Total annual rainfall (5 years = 51.74 in.
Number of storms per year = 115
Mean depth per event = 0.45 in.
80% storm depth = 0.72 in.
Design duration = 10.3 hrs
Critical period = June, July and August
Time between storms critical period = 57.37 hrs

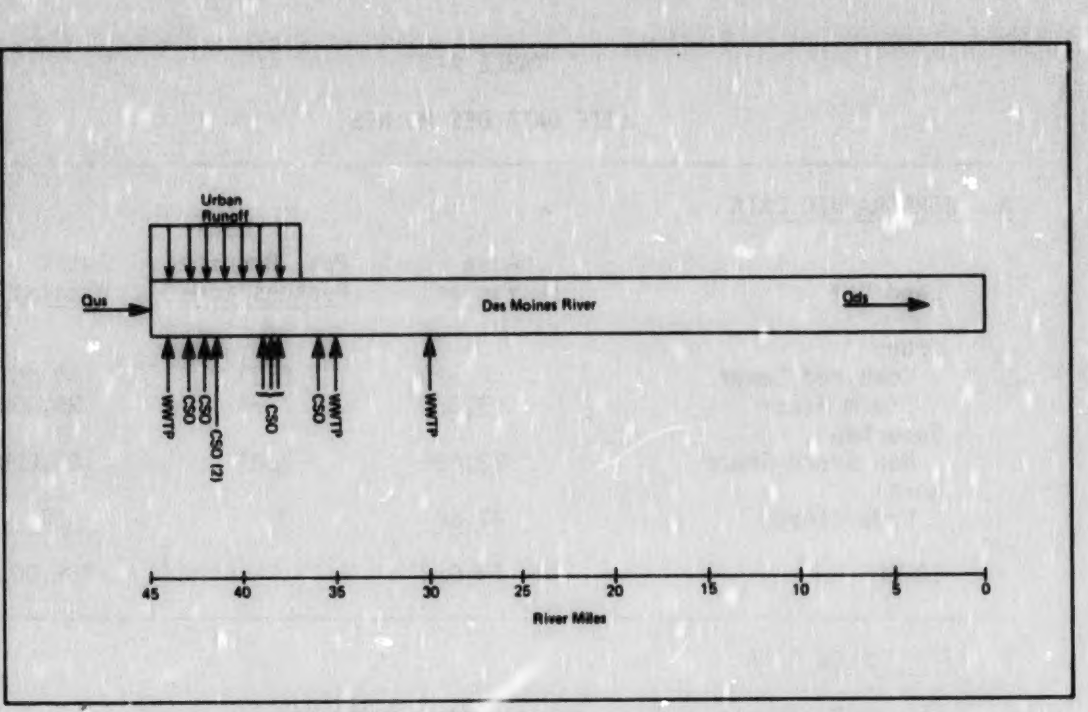

Urban Runoff
Qus
Des Moines River
Qds
WWTP
CSO
CSO
CSO (2)
CSO
CSO
WWTP
WWTP
45
40
35
30
25
20
15
10
5
0
River Miles

FIGURE A-3. CONCEPTUAL SKETCH FOR DES MOINES, IOWA.

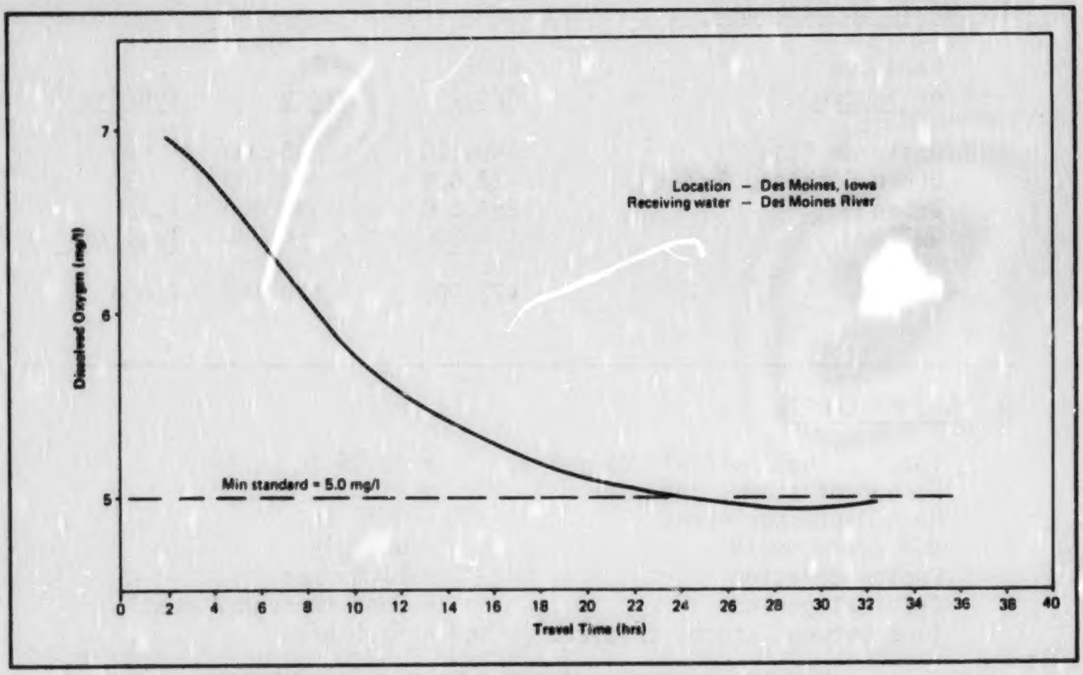


FIGURE A-4. D.O. CURVE FOR DES MOINES RIVER.

TABLE A-2

SITE DATA DES MOINES

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	4,830	8.33	40,000
Storm Sewer	3,878	7.74	30,000
Suburban			
Non Storm Sewer	23,639	7.83	185,000
Rural			
Undeveloped	37,681	0	0
TOTAL	70,028		255,000

B. STREAMFLOW DATA

Q_{us} = 2,186 cfs

Temp = 23.5° C

DO = 7.1 mg/l

K_2 = 1.883 - downstream

Q_{ds} = 3,346 cfs

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	149,000	315,000	590
Urban Combined Sewer	28,600	48,400	90
Urban	282,300	592,000	1,320
WWTP	12,200	54,780	less than 5
TOTAL	472,100	1,010,180	2,000

D. RAINFALL DATA

Total annual rainfall (5 years) = 38.05 in.

Number of storms per year = 119

Mean depth per event = 0.32 in.

80% storm depth = 0.51 in.

Design duration = 12.65 hrs

Critical period = June through August

Time between storms critical period = 67.5 hrs

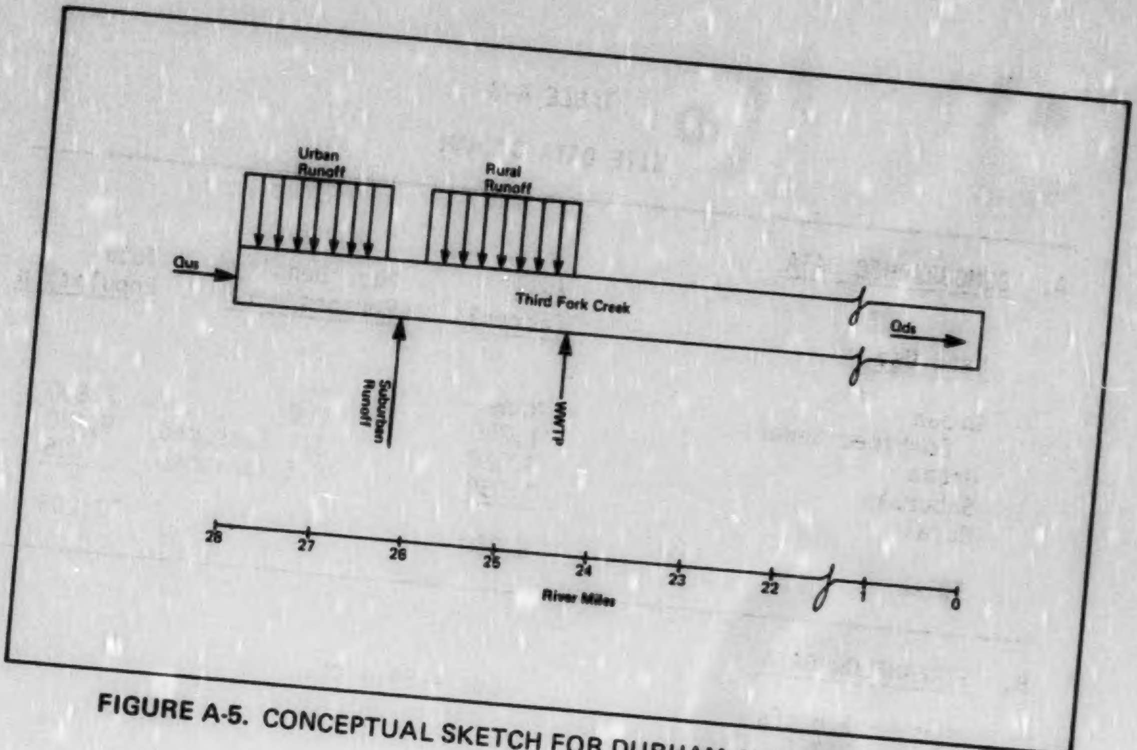

Urban Runoff
Rural Runoff
Qus
Third Fork Creek
Qds
Suburban Runoff
WWTP
28
27
26
25
24
23
22
1
0
River Miles

FIGURE A-5. CONCEPTUAL SKETCH FOR DURHAM, NORTH CAROLINA.

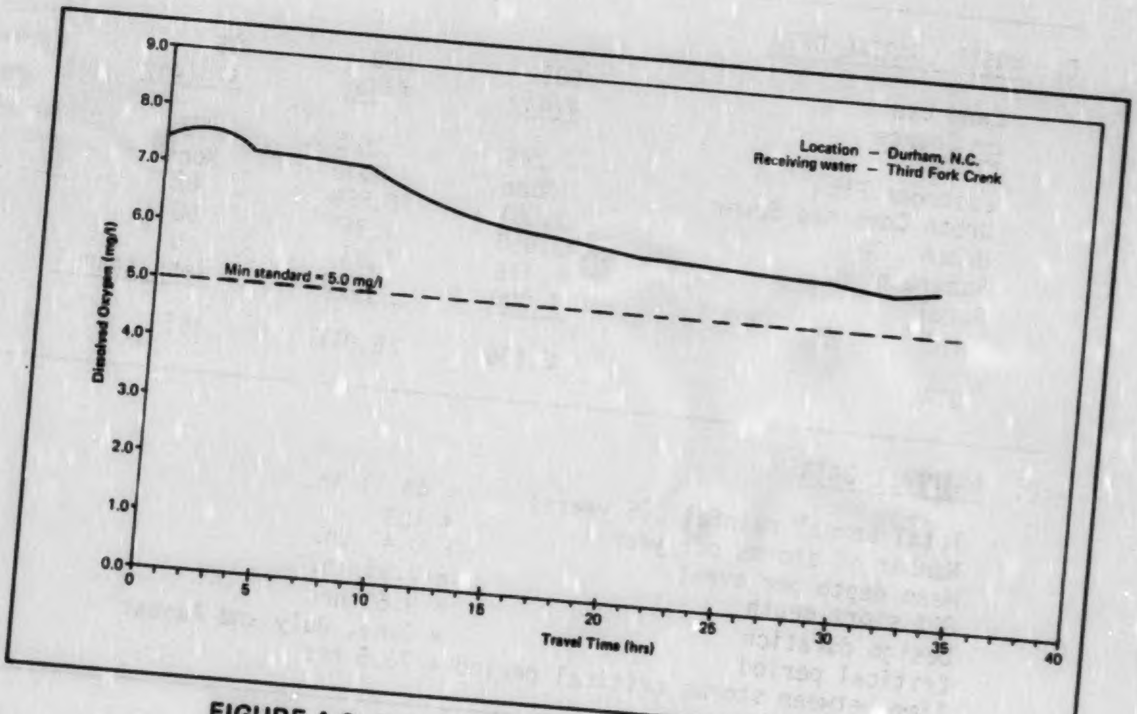


FIGURE A-6. D.O. CURVE FOR THIRD FORK RIVER.

TABLE A-3

SITE DATA DURHAM

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	None	--	--
Urban	1,250	6.0	7,500
Suburban	3,060	3.0 (assumed)	9,180
Rural	1,050	0.5 (assumed)	525
TOTAL	5,360		17,205

B. STREAMFLOW DATA

Qus = 6.8 cfs
Qds = 94.4 cfs
Temp = 25° C
DO = 7.4
K_2 = 2.5

C. WASTE LOADING DATA

Land Use or Source	BOD$_5$ #/day	UOD #/day	SS ton/day
Upstream Flow	249	725	2
Urban Combined Sewer	None	None	None
Urban	3,881	10,899	82
Suburban	3,090	8,856	66
Rural	416	1,211	5
WWTP	1,000	3,320	less than 1
TOTAL	8,636	25,011	155

D. RAINFALL DATA

Total annual rainfall (5 years) = 44.11 in.
Number of storms per year = 103
Mean depth per event = 0.43 in.
80% storm depth = 0.69 in.
Design duration = 9.63 hrs
Critical period = June, July and August
Time between storms critical period = 76.5 hrs

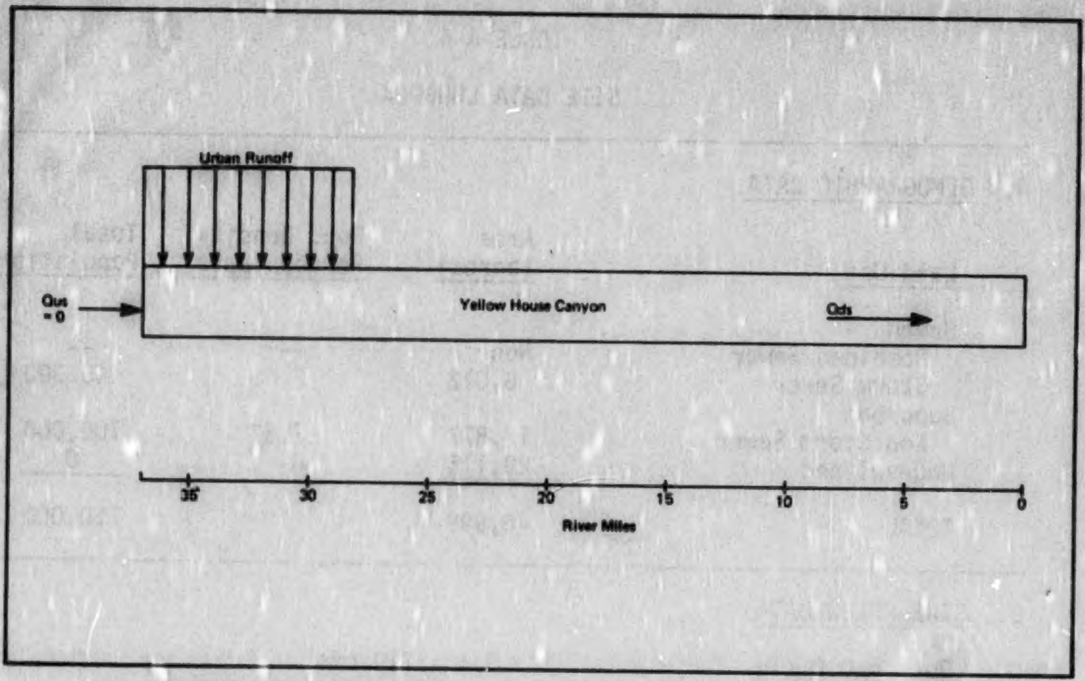

Urban Runoff
Qus
= 0
Yellow House Canyon
Qds
35
30
25
20
15
10
5
0
River Miles

FIGURE A-7. CONCEPTUAL SKETCH FOR LUBBOCK, TEXAS.

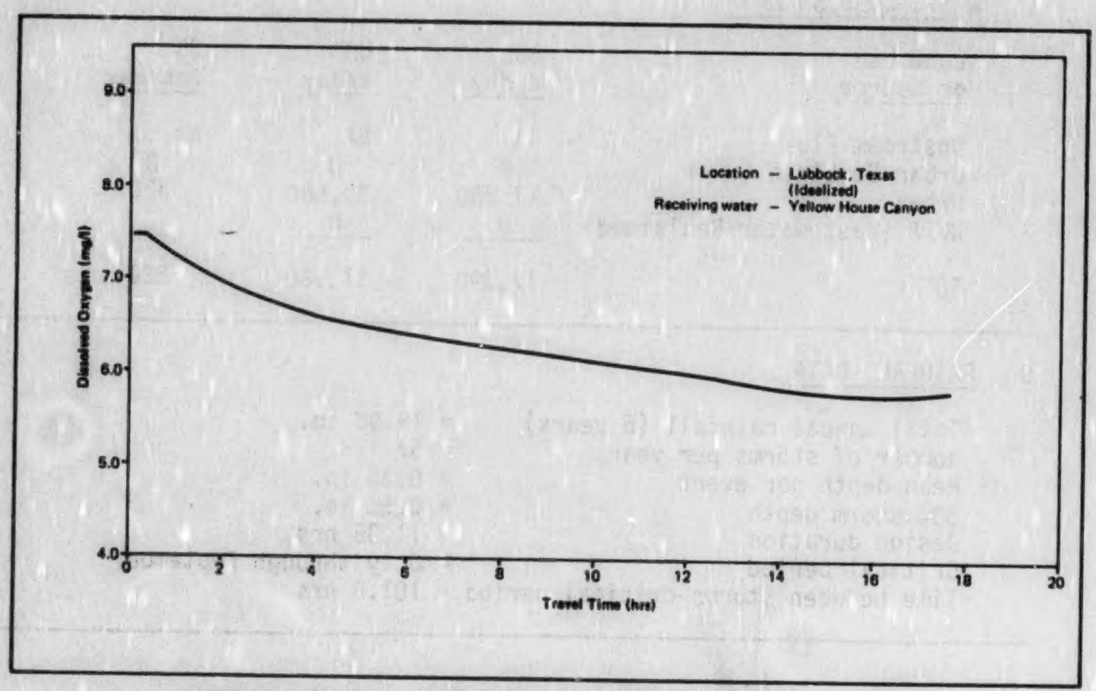


FIGURE A-8. D.O. CURVE FOR YELLOW HOUSE CANYON.

TABLE A-4

SITE DATA LUBBOCK

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	None	--	--
Storm Sewer	6,012	7.48	45,000
Suburban			
Non Storm Sewer	13,872	7.57	105,000
Undeveloped	29,115	0	0
TOTAL	48,999		150,000

B. STREAMFLOW DATA

Qus = 0.0 cfs

Temp = 27.0° C

DO = 8.0

K_2 = 7.1 - downstream

Qds = 219 cfs

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	NA	NA	NA
Urban Combined Sewer	0	0	0
Urban	17,390	31,580	320
WWTP (Wastewater Reclaimed)	0	0	0
TOTAL	17,390	31,580	320

D. RAINFALL DATA

Total annual rainfall (5 years) = 19.98 in.
Number of storms per year = 57
Mean depth per event = 0.35 in.
80% storm depth = 0.56 in.
Design duration = 11.35 hrs
Critical period = July through September
Time between storms critical period = 101.8 hrs

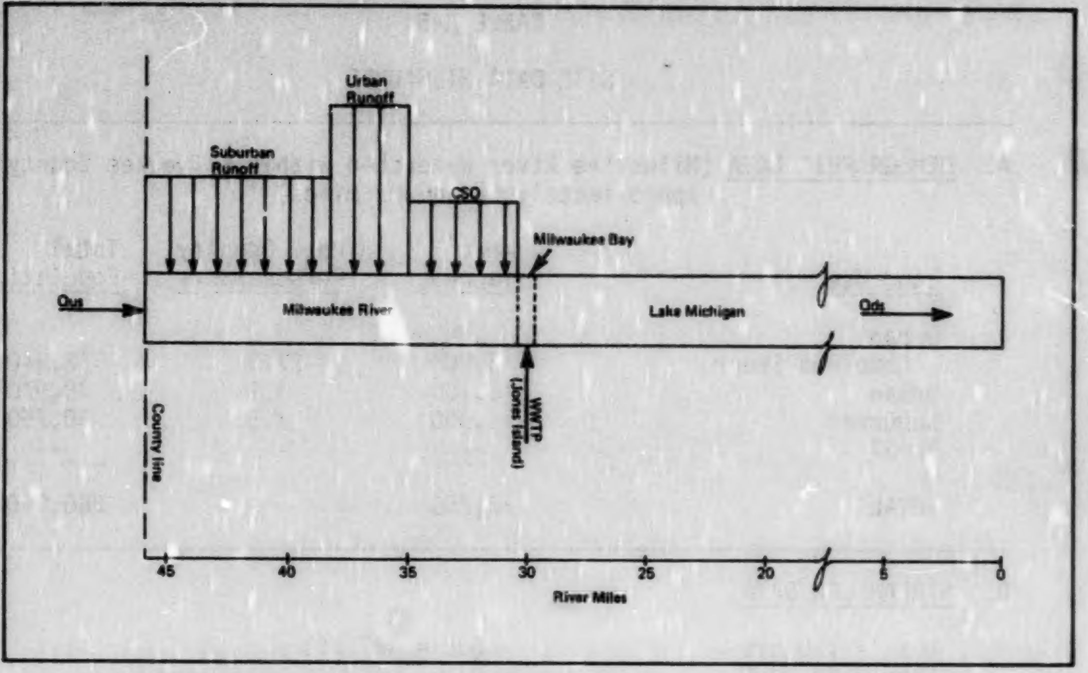

Urban Runoff
Suburban Runoff
CSO
Milwaukee Bay
Qus
Milwaukee River
Lake Michigan
Qds
County line
WWTP (Jones Island)
45
40
35
30
25
20
5
0
River Miles

FIGURE A-9. CONCEPTUAL SKETCH FOR MILWAUKEE, WISCONSIN.

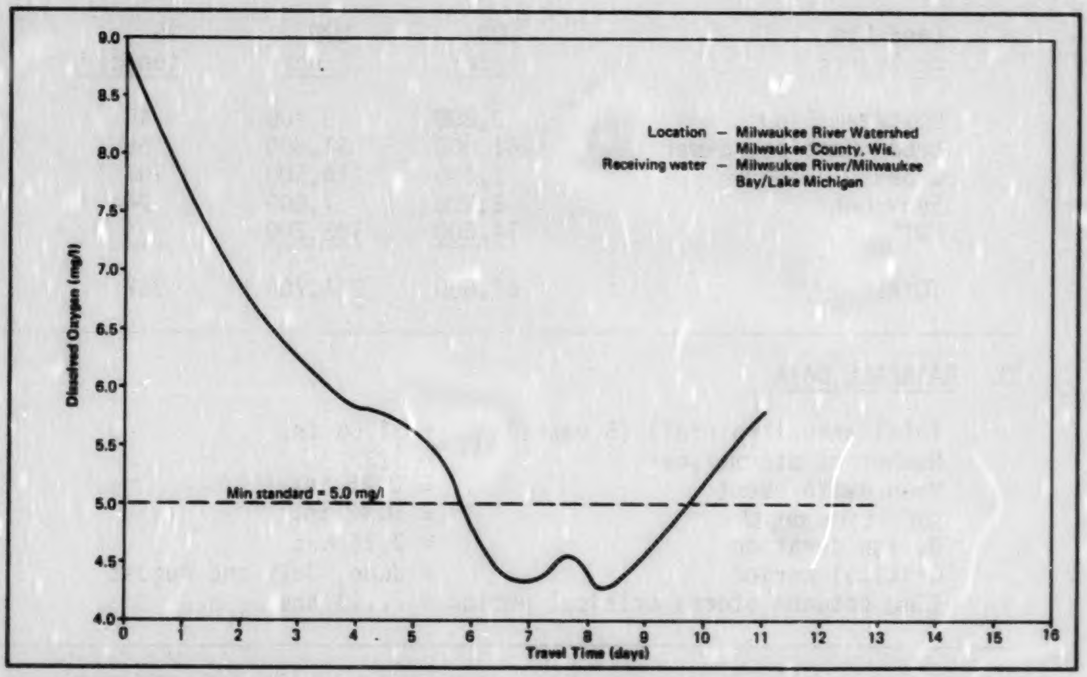


FIGURE A-10. D.O. CURVE FOR MILWAUKEE RIVER AND MILWAUKEE BAY.

TABLE A-5

SITE DATA MILWAUKEE

A. DEMOGRAPHIC DATA (Milwaukee River Watershed within Milwaukee County approximately 52 square miles)

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban Combined Sewer	5,800	27.3	158,340
Urban	15,100	4.7	70,970
Suburban	12,300	2.5	30,750
Rural	--	--	--
TOTAL	33,200		260,060

B. STREAMFLOW DATA

Qus = 170 cfs   Qds = 467 cfs
Temp = 22.2° C
DO = 8.9 mg/l
K_2 = 1.1 day^{-1}

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	3,200	8,700	46
Urban Combined Sewer	41,000	81,500	56
Urban	5,300	14,500	107
Suburban	2,900	7,800	74
WWTP	14,600	102,200	4
TOTAL	67,000	214,700	287

D. RAINFALL DATA

Total annual rainfall (5 years) = 31.68 in.
Number of storms/year = 123
Mean depth/event = 0.26 in.
80% storm depth = 0.42 in.
Design duration = 7.76 hrs
Critical period = June, July and August
Time between storms critical period = 70.13 hrs

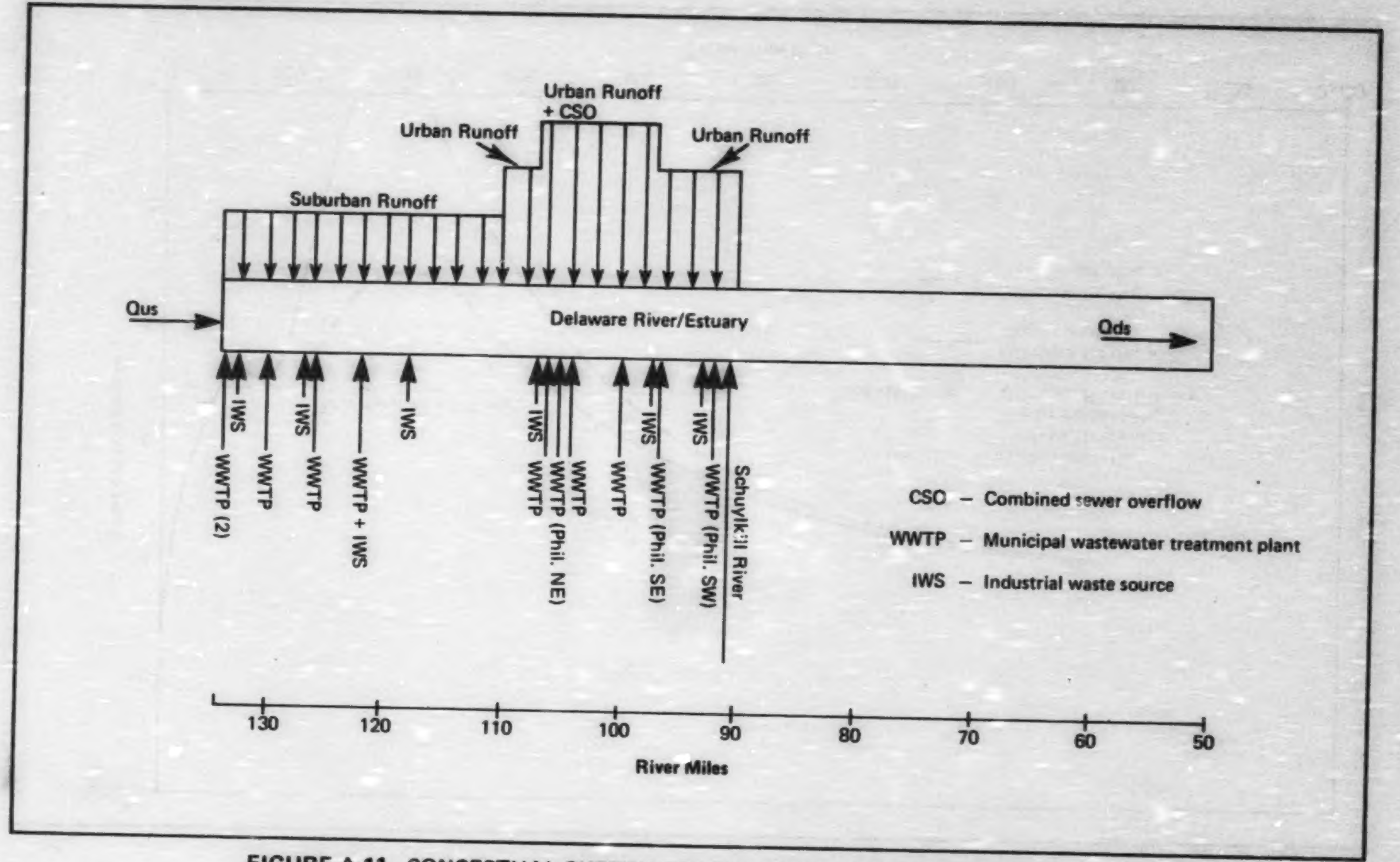

Urban Runoff
+ CSO
Urban Runoff
Urban Runoff
Suburban Runoff
Qus
Delaware River/Estuary
Qds
IWS
WWTP (2)
WWTP
IWS
WWTP
WWTP + IWS
IWS
IWS
WWTP
WWTP (Phil. NE)
WWTP
WWTP
IWS
WWTP (Phil. SE)
IWS
WWTP (Phil. SW)
Schuylkill River
CSO – Combined sewer overflow
WWTP – Municipal wastewater treatment plant
IWS – Industrial waste source
130
120
110
100
90
80
70
60
50
River Miles

FIGURE A-11. CONCEPTUAL SKETCH FOR PHILADELPHIA, PENNSYLVANIA.

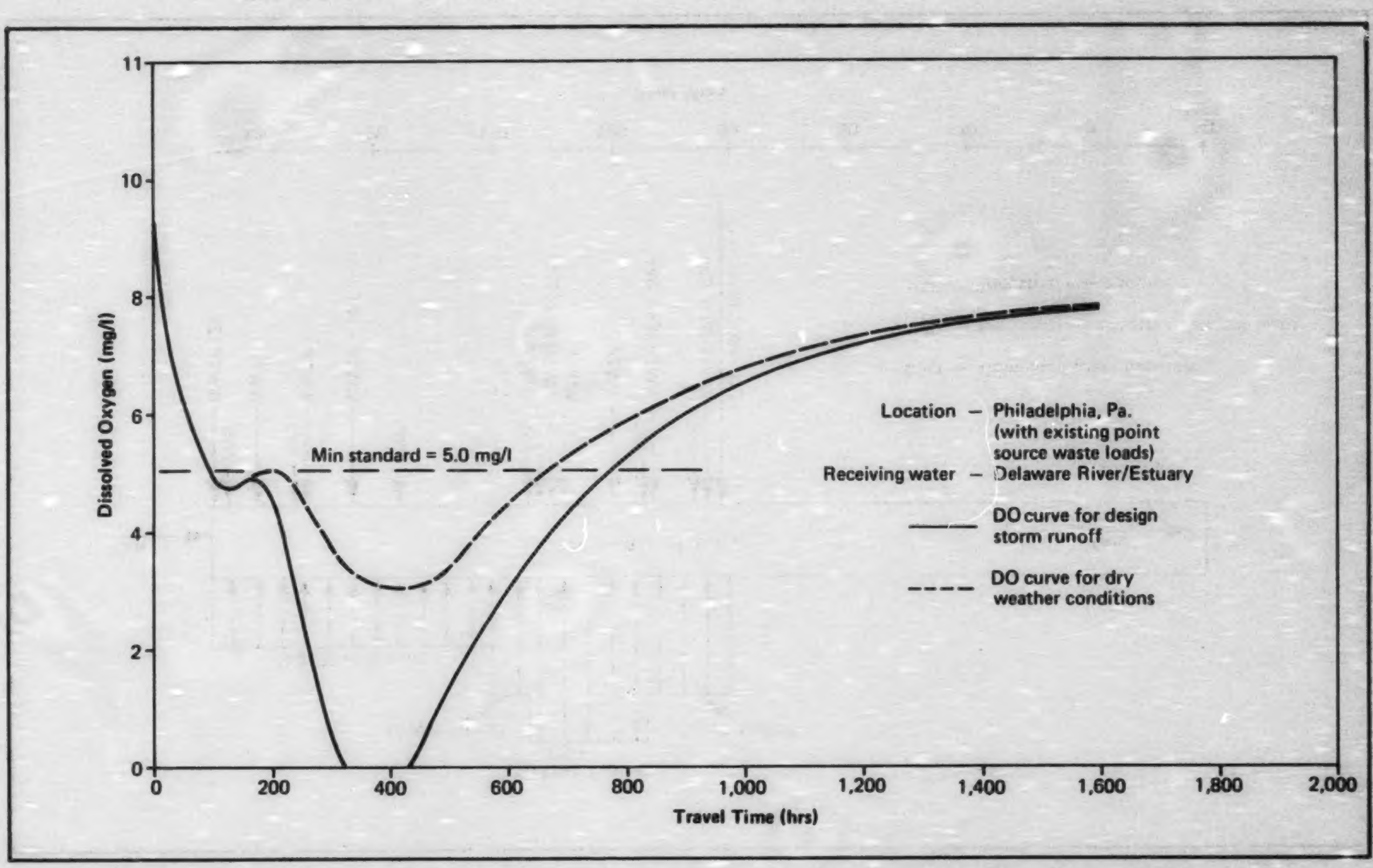


FIGURE A-12. D.O. CURVE FOR DELAWARE RIVER/ESTUARY WITH EXISTING POINT SOURCE WASTE LOADS.

TABLE A-6

SITE DATA PHILADELPHIA

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	22,400	9.86	220,864
Storm Sewer	105,600	9.67	1,021,152
Suburban			
Non Storm Sewer	321,920	8.487	2,732,135
TOTAL	449,920		3,974,151

B. STREAMFLOW DATA

Qus = 4,167 cfs

Qds = 9,622 cfs

Temp = 26.0° C

DO = 9.3 mg/l

K_2 = 0.17 - downstream

C. WASTE LOADING DATA (Present Conditions)

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	89,801	288,599	1,750
Urban Combined Sewer	165,202	335,886	280
Urban and Suburban	515,797	866,360	3,710
WWTP (includes Schuylkill R.)	297,664	724,401	40
TOTAL	1,068,464	2,215,246	5,780

D. RAINFALL DATA

Total annual rainfall (5 years) = 48.80 in.

Number of storms per year = 113

Mean depth per event = 0.43 in.

80% storm depth = 0.69 in.

Design duration = 16.46 hrs

Critical period = June, July and August

Time between storms critical period = 74.24 hrs

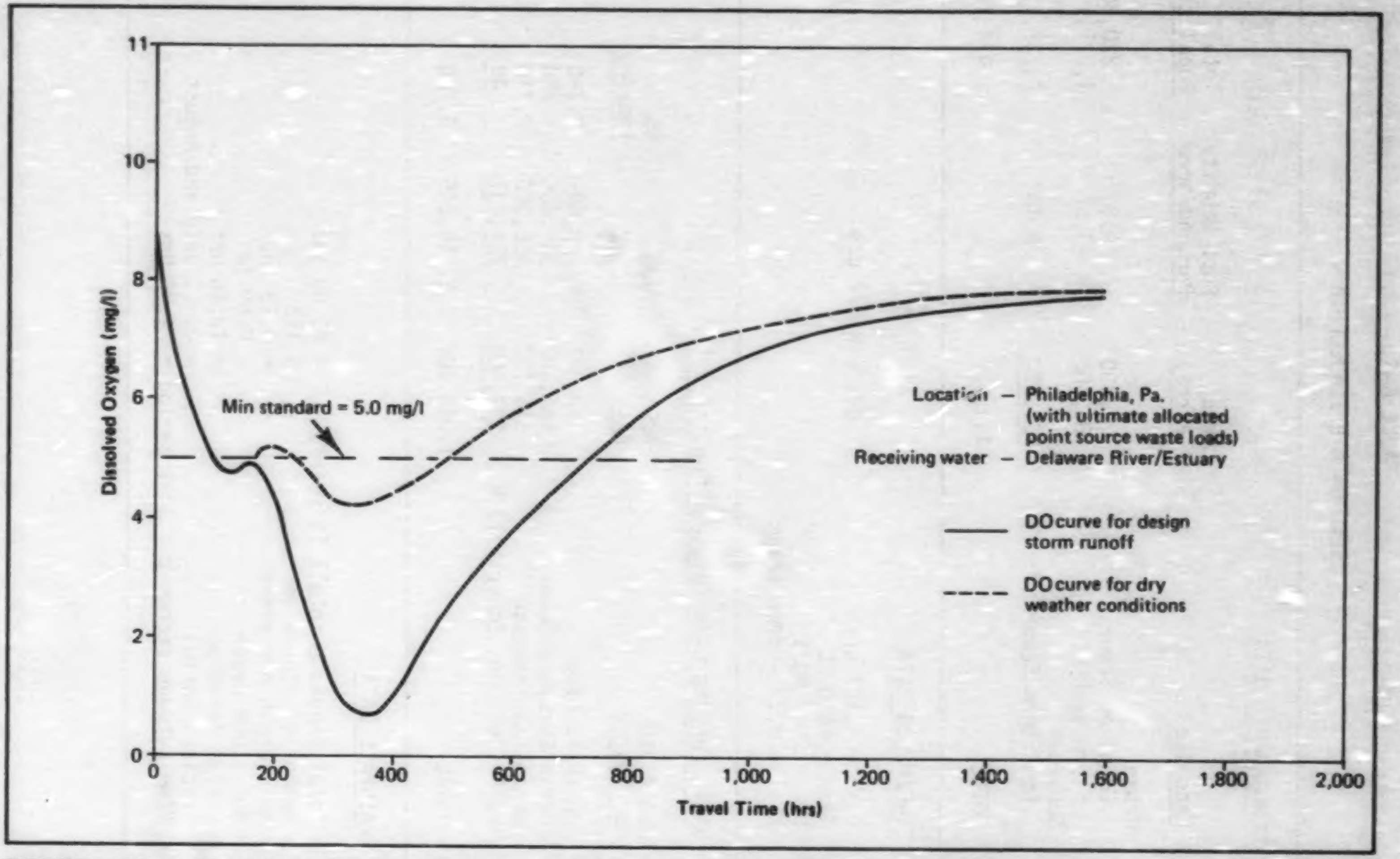


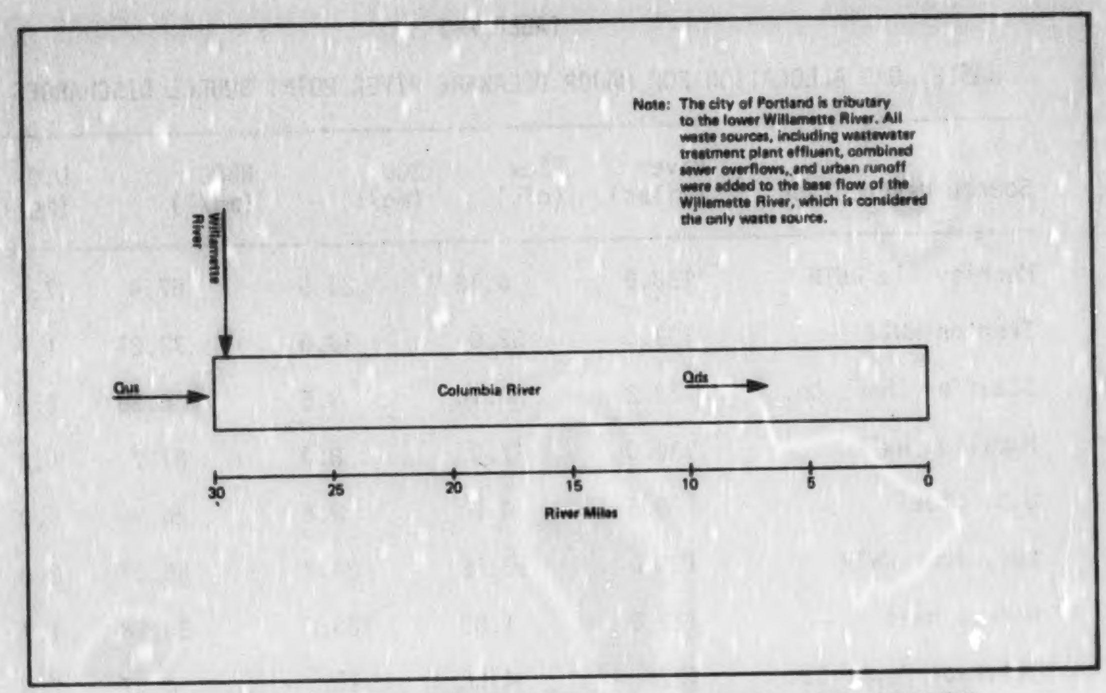
FIGURE A-13. D.O. CURVE FOR DELAWARE RIVER/ESTUARY WITH APPROXIMATE ULTIMATE ALLOCATED POINT SOURCE WASTE LOADS.

TABLE A-7

WASTE LOAD ALLOCATION FOR MAJOR DELAWARE RIVER POINT SOURCE DISCHARGES

Source Description	River (miles)	Flow (cfs)	BOD$_{20}$ (mg/l)	NBOD (mg/l)	D.O. (mg/l)
Morrisville WWTP	133.9	6.15	23.5	167.4	7.1
Trenton WWTP	133.5	32.0	13.6	72.21	1.7
Stauffer Chem. Co.	133.2	0.10	9.5	6.86	2.0
Hamilton WWTP	130.0	17.0	8.0	61.7	4.2
U.S. Steel	126.5	54.0	8.6	26.96	6.0
Levittown WWTP	126	13.06	34.3	85.87	3.0
Rohn & Haas	122.5	1.80	283.6	34.28	1.7
Paterson Paper Co.	122	4.50	18.1	4.57	2.0
Tennecs	118	4.05	27.0	143.96	2.8
Allied Chem. Corp.	106	0.20	15.5	13.71	2.0
Pennsauken	105.5	5.9	48.1	114.25	0.7
Philadelphia NE WWTP	105	326.0	39.5	62.93	2.1
Camden-North WWTP	104.5	5.42	43.8	137.1	0.1
Camden-Main WWTP	100	47.0	47.0	59.41	2.6
N. J. Zinc	97.5	17.2	5.4	57.58	0.0
Philadelphia SE WWTP	97	210.0	29.4	34.55	3.6
Mobil Oil	92.5	10.9	72.4	32.9	1.4
Philadelphia SW WWTP	92	265.5	20.3	39.99	3.7
Schuylkill River	91.5	1,500.0	4.2	4.57	7.0
Total #/day			197,777	366,206	

BOD_5 = 117,634 #/day
UOD = 563,983 #/day



Note: The city of Portland is tributary to the lower Willamette River. All waste sources, including wastewater treatment plant effluent, combined sewer overflows, and urban runoff were added to the base flow of the Willamette River, which is considered the only waste source.

Willamette River
Qus
Columbia River
Qds
30
25
20
15
10
5
0
River Miles

FIGURE A-14. CONCEPTUAL SKETCH FOR PORTLAND, OREGON.

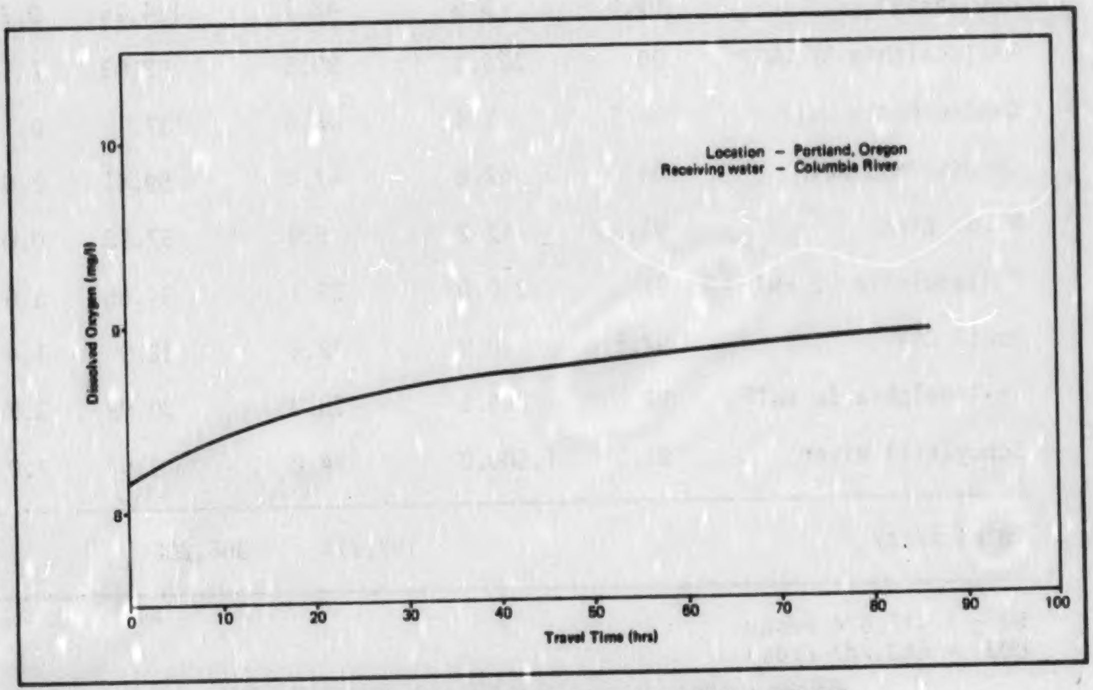


FIGURE A-15. D.O. CURVE FOR COLUMBIA RIVER.

TABLE A-8

SITE DATA PORTLAND

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	3,420	6.57	23,000
Storm Sewer	29,754	8.67	258,000
Suburban			
Non Storm Sewer	62,432	8.71	544,000
Undeveloped	75,291	0	0
TOTAL	170,897		825,000

B. STREAMFLOW DATA

Qus = 3,919 cfs　　Qds = 5,465 cfs
Temp = 17° C
DO = 8.4
K_2 = 2.0 - downstream

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	12,670	61,400	1,110
Urban Combined Sewer	12,240	20,374	40
Urban	164,000	379,900	1,420
WWTP	15,480	36,890	10
TOTAL	204,390	498,564	2,580

D. RAINFALL DATA

Total annual rainfall (5 years) = 40.49 in.
Number of storms per year = 148
Mean depth per event = 0.27 in.
80% storm depth = 0.44 in.
Design duration = 9.57 hrs
Critical period = September through November
Time between storms critical period = 55.80 hrs

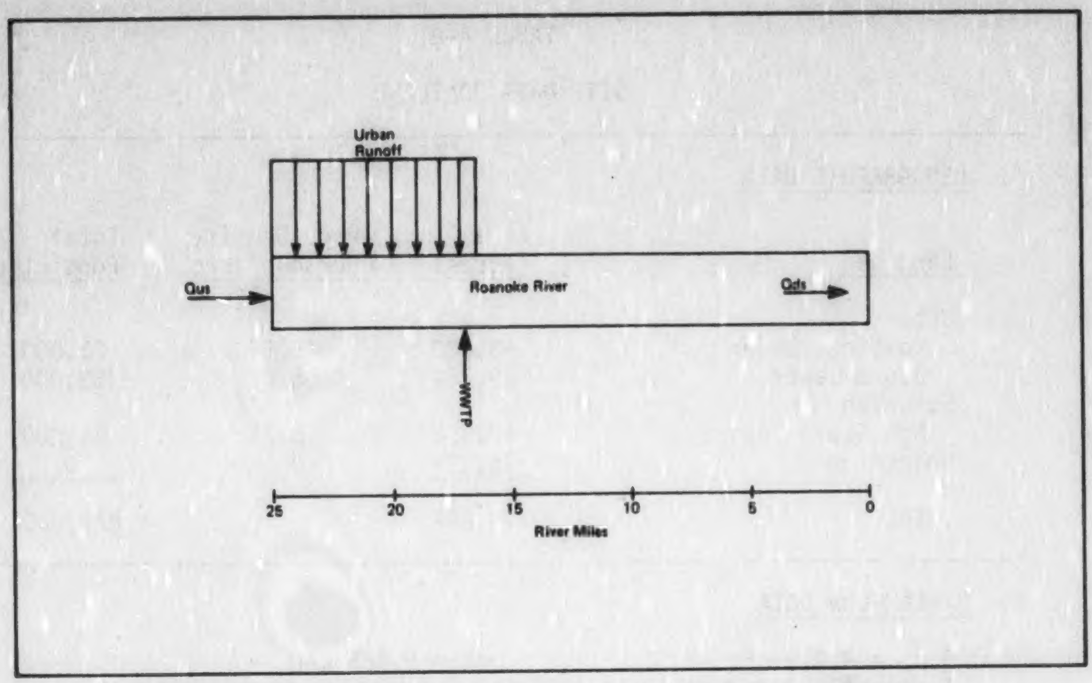

Urban Runoff
Qus
Roanoke River
Qds
WWTP
25
20
15
10
5
0
River Miles

FIGURE A-16. CONCEPTUAL SKETCH FOR ROANOKE, VIRGINIA.

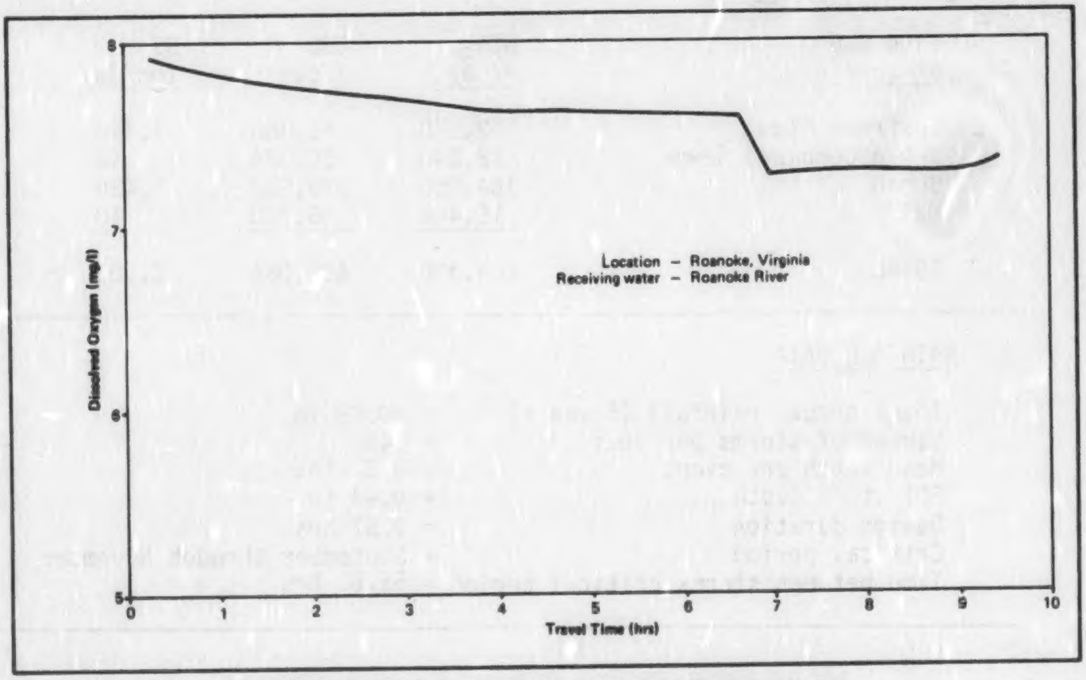


FIGURE A-17. D.O. CURVE FOR ROANOKE RIVER.

TABLE A-9

SITE DATA ROANOKE

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	None	--	--
Storm Sewer	7,240	7.87	57,000
Suburban			
Non Storm Sewer	12,516	7.99	100,000
Rural			
Undeveloped	22,243	0	0
TOTAL	41,999		157,000

B. STREAMFLOW DATA

Qus = 168 cfs

Temp = 26.6° C

DO = 8.0 mg/l

K_2 = 16.0 - downstream

Qds = 512 cfs

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	980	2,200	45
Urban Combined Sewer	0	0	0
Urban	10,240	31,690	404
WWTP	1,260	12,551	2
TOTAL	12,480	46,441	451

D. RAINFALL DATA

Total annual rainfall (5 years) = 49.19 in.

Number of storms/year = 117

Mean depth per event = 0.42 in.

80% storm depth = 0.68 in.

Design duration = 11.76 hrs

Critical period = July through September

Time between storms critical period = 60.65 hrs

TABLE A-10

SITE DATA SAN FRANCISCO BAY AREA

A. DEMOGRAPHIC DATA (Total Area)

Land Use	Area (Sq. Miles)	Pop. Density Persons/acre	Total Population
Urban Combined Sewer	47.8	23.7	725,000
Urban	508	7.07	2,300,000
Rural	1,297	0.48	397,000
TOTAL	1,852.8		3,422,000

B. STREAMFLOW DATA (South Bay Only)

Qus = 72.2 cfs

Temp = 15.6° C

DO = 9.0

K_2 = Unknown - downstream

Qds = Unknown

C. WASTE LOADING DATA (South Bay Only)

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	Assumed Negligible	Assumed Negligible	0
Urban Combined Sewer	None	None	0
Urban	153,421	281,682	1,807
Industrial	53,626	98,458	421
WWTP (all AWT)	6,870(±)	20,200	3
TOTAL	213,917	400,340	2,231

D. RAINFALL DATA

Total annual rainfall (5 years) = 19.66 in.

Number of storms per year = 61

Mean depth per event = 0.32 in.

80% storm depth = 0.52 in.

Design duration = 9.53 hrs

Critical period = November, December and January

Time between storms critical period = 69.11 hrs

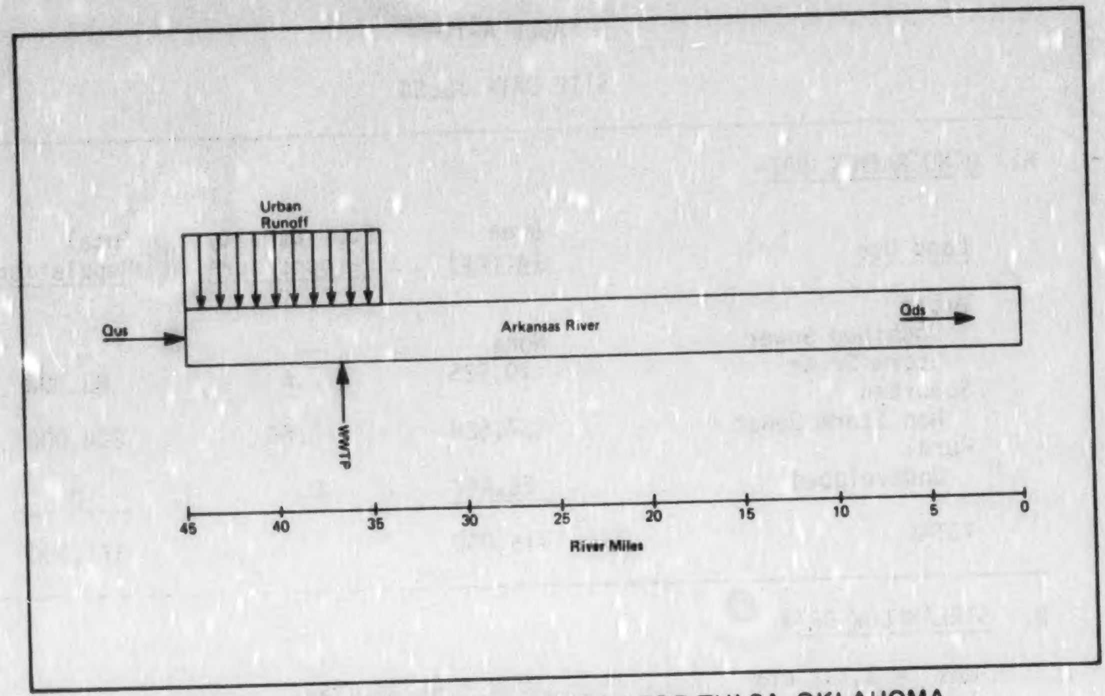

Urban Runoff
Qus
Arkansas River
Qds
WWTP
45
40
35
30
25
20
15
10
5
0
River Miles

FIGURE A-18. CONCEPTUAL SKETCH FOR TULSA, OKLAHOMA.

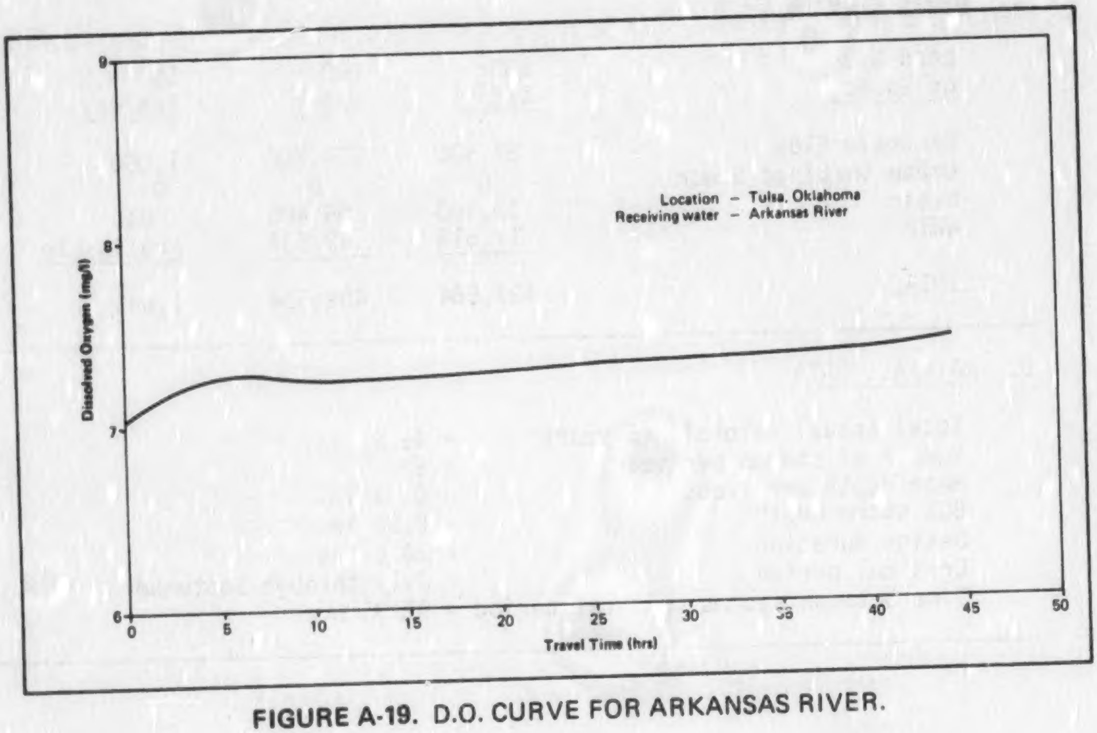


FIGURE A-19. D.O. CURVE FOR ARKANSAS RIVER.

TABLE A-11

SITE DATA TULSA

A. DEMOGRAPHIC DATA

Land Use	Area (acres)	Pop. Density Persons/acre	Total Population
Urban			
Combined Sewer	None	--	--
Storm Sewer	10,925	7.6	83,000
Suburban			
Non Storm Sewer	37,628	7.65	288,000
Rural			
Undeveloped	66,447	0	0
TOTAL	115,000		371,000

B. STREAMFLOW DATA

Qus = 3,711 cfs   Qds = 4,353 cfs
Temp = 28.0° C
DO = 7.0 mg/l
K_2 = 4.6 - downstream

C. WASTE LOADING DATA

Land Use or Source	BOD_5 #/day	UOD #/day	SS ton/day
Upstream Flow	81,970	274,700	1,000
Urban Combined Sewer	0	0	0
Urban	38,100	85,400	840
WWTP	17,514	42,534	Negligible
TOTAL	137,584	402,634	1,840

D. RAINFALL DATA

Total annual rainfall (5 years) = 49.97 in.
Number of storms per year = 82
Mean depth per event = 0.61 in.
80% storm depth = 0.98 in.
Design duration = 20.2 hrs
Critical period = July through September
Time between storms critical period = 97.35 hrs

APPENDIX B

BASE DATA FOR NEEDS ESTIMATION MODEL FOR URBAN RUNOFF

BASE DATA
EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	STATE POPULATIONS 1990 USERS 1000 PERSONS	STATE POPULATIONS 1990 EPA 1000 PERSONS	COM SEWER OVERFLOW AREA 1000 ACRES	COM SEWER OVERFLOW POP. 1000 PER	URBANIZED AREA POP.	URBANIZED AREA AREA SQMI	SMSA POPULATIONS 1970	SMSA POPULATIONS 1990	AVG O.A. PER CSO	EPA COST INDEX
1	7	1	BRIDGEPORT CT	3710.	3986.	5.8	72.0	413366.	148.8	794588.	986100.	310.	1.3223
1	7	2	BRISTOL CT	3710.	3986.	0.0	0.0	71732.	37.3	818565.	1007200.	310.	1.3223
1	7	3	DANBURY CT	3710.	3986.	0.0	0.0	66651.	58.9	794588.	986100.	310.	1.3223
1	7	4	HARTFORD CT	3710.	3986.	20.8	275.0	465001.	130.5	818565.	1007200.	310.	1.3223
1	7	5	MERIDEN CT	3710.	3986.	0.0	0.0	98458.	70.7	746614.	859500.	310.	1.3223
1	7	6	NEW BRITAIN CT	3710.	3986.	0.0	0.0	131349.	39.1	818565.	1007200.	310.	1.3223
1	7	7	NEW HAVEN CT	3710.	3986.	14.9	179.0	348341.	107.3	746614.	859500.	310.	1.3223
1	7	8	NORWALK CT	3710.	3986.	1.5	55.0	106707.	41.5	794588.	986100.	310.	1.3223
1	7	9	SPRINGFIELD METRO CT	3710.	3986.	0.0	0.0	58173.	26.7	584038.	681700.	310.	1.3223
1	7	10	STAMFORD CT	3710.	3986.	0.0	0.0	188898.	69.6	794588.	986100.	310.	1.3223
1	7	11	WATERBURY CT	3710.	3986.	1.8	22.0	156986.	50.9	746614.	859500.	310.	1.3223
1	20	12	LEWISTON - AUBURN ME	992.	1182.	8.4	48.0	65212.	67.9	174577.	263000.	138.	1.1132
1	20	13	PORTLAND ME	992.	1182.	15.3	86.0	106599.	55.7	192786.	213400.	138.	1.1132
1	22	14	BOSTON MA	6876.	7052.	21.2	335.0	2652575.	664.4	3715118.	4567600.	227.	1.1132
1	22	15	BROCKTON MA	6876.	7052.	0.0	0.0	148844.	52.5	3715118.	4567600.	227.	1.1132
1	22	16	FALL RIVER MA	6876.	7052.	7.2	92.0	123491.	30.5	445069.	479100.	227.	1.1132
1	22	17	FITCHBURG MA	6876.	7052.	1.7	21.0	78053.	60.9	639071.	759100.	227.	1.1132
1	22	18	LAWRENCE MA	6876.	7052.	12.0	123.0	182438.	72.0	3715118.	4567600.	227.	1.1132
1	22	19	LOWELL MA	6876.	7052.	8.3	87.C	182731.	62.1	3715118.	4567600.	227.	1.1132
1	22	20	NEW BEDFORD MA	6876.	7052.	8.9	101.0	133667.	33.7	445069.	479100.	227.	1.1132
1	22	21	PITTSFIELD MA	6876.	7052.	0.0	0.0	62872.	43.6	149660.	180000.	227.	1.1132
1	22	22	PROVIDENCE METRO MA	6876.	7052.	0.0	0.0	65978.	43.9	770824.	890700.	227.	1.1132
1	22	23	SPRINGFIELD MA	6876.	7052.	32.9	254.0	456135.	211.1	584038.	681700.	227.	1.1132
1	22	24	WORCESTER MA	6876.	7052.	2.1	34.0	287416.	84.4	639071.	759100.	227.	1.1132
1	30	25	LAWRENCE METRO NH	919.	1019.	0.0	0.0	17842.	12.4	3715118.	4567600.	147.	1.1132
1	30	26	MANCHESTER NH	919.	1019.	7.0	71.0	95140.	39.1	225251.	[illegible]000.	147.	1.1132
1	30	27	NASHUA NH	919.	1019.	4.9	36.0	60961.	33.5	225251.	[illegible]0000.	147.	1.1132
1	40	28	FALL RIVER METRO RI	1115.	1134.	4.1	14.0	15901.	12.4	445069.	[illegible]9100.	127.	1.1132
1	40	29	PROVIDENCE RI	1115.	1134.	21.0	335.0	729337.	200.2	770824.	[illegible]0700.	127.	1.1132
2	31	30	ALLENTOWN METRO NJ	8923.	8822.	0.0	0.0	25201.	6.9	547083.	603600.	163.	1.0826
2	31	31	ATLANTIC CITY NJ	8923.	8822.	0.0	0.0	134016.	67.1	175824.	199600.	163.	1.1818
2	31	32	NEW YORK CITY MTR NJ	8923.	8822.	22.2	1204.0	4837265.	2045.0	15862217.	18798000.	163.	1.3223
2	31	33	PHILADELPHIA MTR NJ	8923.	8822.	20.3	201.0	744045.	49.1	4853204.	5678500.	163.	1.1818
2	31	34	TRENTON NJ	8923.	8822.	0.6	4.4	242673.	50.8	305223.	410200.	163.	1.0826
2	31	35	VINELAND NJ	8923.	8822.	0.0	0.0	73579.	85.3	121847.	165600.	163.	1.1818
2	31	36	WILMINGTON METRO NJ	8923.	8822.	0.0	0.0	21593.	12.7	501198.	645100.	163.	1.1818
2	33	37	ALBANY NY	20986.	21799.	19.3	271.0	486525.	150.5	722835.	864900.	208.	1.3223
2	33	38	BINGHAMPTON NY	20986.	21799.	15.2	145.0	167224.	52.3	303204.	326800.	208.	1.3223
2	33	39	BUFFALO NY	20986.	21799.	38.3	642.0	1086594.	213.7	1350597.	1370200.	208.	1.0744
2	33	40	NEW YORK CITY NY	20986.	21799.	92.3	5760.0	11369576.	300.1	15862217.	18798000.	208.	1.3223

BASE DATA
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EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	STATE POPULATIONS 1990 OBERS	1990 EPA	COM SEWER OVERFLOW AREA	POP.	URBANIZED AREA POP.	AREA SQMI	SMSA POPULATIONS 1970	1990	AVG D.A. PER CSO	EPA COST INDEX
				1000 PERSONS		1000 ACRES	1000 PER						
2	33	41	ROCHESTER NY	20946.	21799.	14.3	240.0	401361.	145.7	883578.	1247000.	208.	1.0744
2	33	42	SYRACUSE NY	20946.	21799.	13.2	159.0	374169.	96.2	637251.	743900.	208.	1.3223
2	33	43	UTICA - ROME NY	20946.	21799.	2.5	30.0	180355.	74.6	341019.	351100.	208.	1.3223
3	8	44	WILMINGTON DE	707.	793.	9.2	78.0	349674.	97.1	501198.	685100.	226.	1.1818
3	9	45	WASHINGTON DC	750.	764.	12.7	400.0	754510.	61.4	2865912.	4383100.	187.	1.0083
3	21	46	BALTIMORE MD	5275.	5318.	0.2	1.6	1579781.	309.6	2078379.	2359400.	248.	1.0083
3	21	47	WASHINGTON DC MTR MD	5275.	5318.	0.0	0.0	1009130.	248.0	2865912.	4383100.	248.	1.0083
3	39	48	ALLENTOWN PA	13416.	13342.	0.4	5.0	338316.	91.0	547083.	603600.	141.	1.0826
3	39	49	ALTOONA PA	13416.	13342.	1.5	17.0	81795.	19.6	136203.	152000.	141.	1.0413
3	39	50	ERIE PA	13416.	13342.	4.4	51.0	175263.	43.8	263654.	337600.	141.	1.0744
3	39	51	HARRISBURG PA	13416.	13342.	6.8	6.0	240751.	78.4	413080.	519400.	141.	1.0083
3	39	52	JOHNSTOWN PA	13416.	13342.	2.1	21.0	96186.	28.0	264519.	252300.	141.	1.0413
3	39	53	LANCASTER PA	13416.	13342.	4.8	54.0	117097.	38.7	322501.	402000.	141.	1.0826
3	39	54	PHILADELPHIA PA	13416.	13342.	10.9	159.0	3277021.	702.7	4853208.	5678500.	141.	1.1818
3	39	55	PITTSBURGH PA	13416.	13342.	31.5	667.0	1846042.	596.4	2416930.	2510200.	141.	1.0413
3	39	56	READING PA	13416.	13342.	0.0	0.0	167932.	41.1	298292.	333500.	141.	1.0826
3	39	57	SCRANTON PA	13416.	13342.	17.1	148.0	204205.	98.4	235921.	288100.	141.	1.3223
3	39	58	TRENTON METRO PA	13416.	13342.	0.0	0.0	31475.	13.1	305223.	410200.	141.	1.0826
3	39	59	WILKES-BARRE PA	13416.	13342.	5.9	71.0	222830.	82.5	344275.	429200.	141.	1.3223
3	39	60	YORK PA	13416.	13342.	0.0	0.0	123106.	37.3	332022.	412800.	141.	1.0083
3	47	61	LYNCHBURG VA	6135.	5958.	10.4	70.8	70882.	37.2	123593.	174200.	173.	1.0083
3	47	62	NEWPORT NEWS VA	6135.	5958.	0.3	0.9	268263.	143.3	292442.	333300.	173.	1.0083
3	47	63	NORFOLK VA	6135.	5958.	0.0	0.0	668259.	294.0	681261.	732900.	173.	1.0083
3	47	64	PETERSBURG VA	6135.	5958.	0.0	0.0	100617.	42.4	113822.	153000.	173.	1.0083
3	47	65	RICHMOND VA	6135.	5958.	11.5	200.0	416563.	144.6	533933.	736900.	173.	1.0083
3	47	66	ROANOKE VA	6135.	5958.	0.3	3.0	156021.	66.4	181612.	251100.	173.	1.0083
3	47	67	WASHINGTON DC MTR VA	6135.	5958.	0.9	24.0	715841.	185.1	2865912.	4383100.	173.	1.0083
3	49	68	CHARLESTON WV	1845.	1845.	6.8	16.4	157662.	61.8	229788.	249500.	75.	1.0331
3	49	69	HUNTINGTON WV	1845.	1845.	10.4	85.0	85017.	19.1	254157.	268900.	75.	1.0331
3	49	70	STEUBENVILLE MTR WV	1845.	1845.	6.6	37.0	37230.	26.6	166022.	152100.	75.	1.0413
3	49	71	WHEELING WV	1845.	1845.	6.0	60.0	60705.	20.9	183088.	172300.	75.	1.0413
4	1	72	BIRMINGHAM AL	4090.	3850.	0.0	0.0	558099.	220.6	740742.	882900.	10000.	0.8264
4	1	73	COLUMBUS METRO AL	4090.	3850.	0.0	0.0	25281.	18.7	230187.	284100.	10000.	0.8347
4	1	74	GADSDEN AL	4090.	3850.	0.0	0.0	67706.	55.2	94331.	116100.	10000.	0.8264
4	1	75	HUNTSVILLE AL	4090.	3850.	0.0	0.0	146565.	123.1	228692.	341200.	10000.	0.8264
4	1	76	MOBILE AL	4090.	3850.	0.0	0.0	257816.	168.4	377439.	453400.	10000.	0.9256
4	1	77	MONTGOMERY AL	4090.	3850.	0.0	0.0	138983.	51.1	201725.	235800.	10000.	0.8264
4	1	78	TUSCALOOSA AL	4090.	3850.	0.0	0.0	85875.	43.7	116259.	149900.	10000.	0.8264
4	10	79	FT LAUDERDALE FL	10978.	11728.	0.0	0.0	613797.	212.2	627717.	1204500.	88.	0.8843
4	10	80	GAINESVILLE FL	10978.	11728.	0.0	0.0	69329.	29.8	105637.	162400.	88.	0.8347

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EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	STATE POPULATIONS 1990 OBERS 1000 PERSONS	STATE POPULATIONS 1990 EPA 1000 PERSONS	COM SEWER OVERFLOW AREA 1000 ACRES	COM SEWER OVERFLOW POP. 1000 PER	URBANIZED AREA POP.	URBANIZED AREA AREA SQMI	SMSA POPULATIONS 1970	SMSA POPULATIONS 1990	AVG D.A. DEP (30	EPA COST INDEX
4	10	81	JACKSONVILLE FL	10978.	11728.	0.0	0.0	529585.	351.3	531592.	729700.	88.	0.8347
4	10	82	MIAMI FL	10978.	11728.	0.0	0.0	1219661.	258.7	1277562.	2332500.	88.	0.8843
4	10	83	ORLANDO FL	10978.	11728.	0.0	0.0	305479.	131.7	438866.	673400.	88.	0.8843
4	10	84	PENSACOLA FL	10978.	11728.	0.0	0.0	166619.	66.4	244517.	274900.	88.	0.9256
4	10	85	ST PETERSBURG FL	10978.	11728.	0.0	0.0	495159.	160.5	1019726.	1702700.	88.	0.8843
4	10	86	TALLAHASSEE FL	10978.	11728.	0.0	0.0	77851.	29.8	103835.	167000.	88.	0.8347
4	10	87	TAMPA FL	10978.	11728.	0.0	0.0	368742.	130.5	1019726.	1702700.	88.	0.8843
4	10	88	WEST PALM BEACH FL	10978.	11728.	0.0	0.0	287561.	136.4	352158.	562700.	88.	0.8843
4	11	89	ALBANY GA	5907.	5667.	12.0	76.0	78512.	32.9	89882.	112200.	1003.	0.8347
4	11	90	ATLANTA GA	5907.	5667.	9.5	108.0	1172778.	435.0	1393929.	2107600.	1003.	0.8347
4	11	91	AUGUSTA GA	5907.	5667.	4.0	73.0	126770.	82.8	250093.	265900.	1003.	0.8347
4	11	92	CHATTANOOGA METRO GA	5907.	5667.	0.0	0.0	28987.	17.2	305572.	439700.	1003.	0.8347
4	11	93	COLUMBUS GA	5907.	5667.	4.3	47.0	183335.	87.5	239197.	248100.	1003.	0.8347
4	11	94	MACON GA	5907.	5667.	0.0	0.0	128065.	51.3	206900.	269500.	1003.	0.8347
4	11	95	SAVANNAH GA	5907.	5667.	6.5	100.0	163753.	68.1	188275.	201200.	1003.	0.8347
4	18	96	CINCINNATI METRO KY	3982.	3741.	0.0	0.0	196978.	59.9	1389090.	1635800.	103.	1.0331
4	18	97	HUNTINGTON METRO KY	3982.	3741.	2.8	23.3	53316.	22.6	254157.	268900.	103.	1.0331
4	18	98	LEXINGTON KY	3982.	3741.	0.0	0.0	159538.	30.9	174577.	263000.	103.	1.0331
4	18	99	LOUISVILLE KY	3982.	3741.	1.6	22.0	657900.	183.8	827927.	1146300.	103.	1.0331
4	18	100	OWENSBORO KY	3982.	3741.	3.5	39.0	53133.	11.9	79602.	105200.	103.	1.1570
4	25	101	BILOXI - GULFPORT MS	2450.	2359.	0.0	0.0	121601.	63.7	134527.	139300.	160.	0.9256
4	25	102	JACKSON MS	2450.	2359.	0.0	0.0	190060.	72.2	258801.	349200.	160.	0.9256
4	25	103	MEMPHIS METRO MS	2450.	2359.	0.0	0.0	8931.	3.2	771631.	1010700.	160.	1.1570
4	34	104	ASHEVILLE NC	6465.	5880.	0.0	0.0	72451.	38.2	145311.	192000.	1970.	0.6281
4	34	105	CHARLOTTE NC	6465.	5880.	0.0	0.0	279530.	109.7	410091.	587300.	1970.	0.6281
4	34	106	DURHAM NC	6465.	5880.	0.0	0.0	100764.	43.0	190723.	296200.	1970.	0.6281
4	34	107	FAYETTEVILLE NC	6465.	5880.	0.0	0.0	161370.	73.3	212415.	248400.	1970.	0.6281
4	34	108	GREENSBORO NC	6465.	5880.	0.0	0.0	152252.	61.2	604957.	895900.	1970.	0.6281
4	34	109	HIGHPOINT NC	6465.	5880.	0.0	0.0	93547.	52.1	604957.	895900.	1970.	0.6281
4	34	110	RALEIGH NC	6465.	5880.	0.0	0.0	152289.	70.5	228855.	324900.	1970.	0.6281
4	34	111	WILMINGTON NC	6465.	5880.	0.0	0.0	57645.	29.3	107406.	128100.	1970.	0.6281
4	34	112	WINSTON-SALEM NC	6465.	5880.	0.0	0.0	142584.	66.0	604957.	895900.	1970.	0.6281
4	41	113	AUGUSTA METRO SC	3122.	3023.	0.0	0.0	27183.	15.6	250093.	265900.	2000.	0.8347
4	41	114	CHARLESTON SC	3122.	3023.	0.0	0.0	228399.	99.2	304493.	319600.	2000.	0.6281
4	41	115	COLUMBIA SC	3122.	3023.	0.0	0.0	281781.	103.3	323563.	435100.	2000.	0.6281
4	41	116	GREENVILLE SC	3122.	3023.	0.0	0.0	157073.	70.9	300137.	431700.	2000.	0.6281
4	43	117	CHATTANOOGA TN	5190.	4800.	2.3	26.0	198633.	90.5	305572.	439700.	322.	0.8347
4	43	118	KNOXVILLE TN	5190.	4800.	0.0	0.0	190502.	86.1	401136.	500100.	322.	0.8347
4	43	119	MEMPHIS TN	5190.	4800.	0.0	0.0	655085.	192.3	771631.	1010700.	322.	1.1570
4	43	120	NASHVILLE TN	5190.	4800.	14.7	100.0	448444.	343.5	542063.	769100.	322.	0.8268

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5	14	121	AURORA IL	13056.	13177.	4.3	20.4	232917.	76.8	6993404.	8334800.	358.	1.1570
5	14	122	BLOOMINGTON IL	13056.	13177.	4.0	21.8	69392.	19.9	104605.	131900.	358.	1.1570
5	14	123	CHAMPAIGN IL	13056.	13177.	0.0	0.0	100417.	18.3	163619.	195900.	358.	1.1570
5	14	124	CHICAGO IL	13056.	13177.	243.7	4416.0	6185156.	978.1	7628518.	9112800.	358.	1.1570
5	14	125	DAVENPORT METRO IL	13056.	13177.	1.0	7.4	139824.	35.3	363344.	391900.	358.	1.1570
5	14	126	DECATUR IL	13056.	13177.	7.2	54.0	99693.	37.2	125269.	174300.	358.	1.1570
5	14	127	DUBUQUE METRO IL	13056.	13177.	0.0	0.0	2400.	1.9	90769.	100200.	358.	1.1570
5	14	128	JOLIET IL	13056.	13177.	9.0	39.0	155500.	55.0	6993404.	8334800.	358.	1.1570
5	14	129	PEORIA IL	13056.	13177.	2.9	22.9	247121.	104.7	342680.	419300.	358.	1.1570
5	14	130	ROCKFORD IL	13056.	13177.	0.0	0.0	206084.	61.0	272627.	317200.	358.	1.1570
5	14	131	SPRINGFIELD IL	13056.	13177.	8.1	45.6	120794.	33.5	161669.	226000.	358.	1.1570
5	14	132	ST LOUIS METRO IL	13056.	13177.	9.8	42.0	314476.	114.7	2370219.	2716400.	358.	1.1570
5	15	133	ANDERSON IN	6364.	6433.	29.0	80.7	90700.	45.9	138833.	151700.	365.	1.0331
5	15	134	CHICAGO METRO IN	6364.	6433.	32.3	453.0	529422.	299.1	7628518.	9112800.	365.	1.1570
5	15	135	EVANSVILLE IN	6364.	6433.	15.[illegible]	142.0	142470.	40.5	233370.	303400.	365.	1.1570
5	15	136	FORT WAYNE IN	6364.	6433.	8.1	114.0	225184.	69.0	281229.	387300.	365.	1.0083
5	15	137	INDIANAPOLIS IN	6364.	6433.	34.0	456.0	820259.	301.2	1112945.	1407200.	365.	1.0331
5	15	138	LAFAYETTE IN	6364.	6433.	5.0	73.0	79117.	18.6	109680.	129000.	365.	1.1570
5	15	139	LOUISVILLE METRO IN	6364.	6433.	0.0	0.0	81400.	26.6	827927.	1146300.	365.	1.0331
5	15	140	MUNCIE IN	6364.	6433.	4.3	43.0	90427.	24.5	129576.	143000.	365.	1.0331
5	15	141	SOUTH BEND IN	6364.	6433.	20.2	175.0	265140.	89.2	280804.	315100.	365.	1.1570
5	15	142	TERRA HAUTE IN	6364.	6433.	0.0	0.0	80908.	31.6	175626.	191200.	365.	1.1570
5	23	143	ANN ARBOR MI	10645.	10961.	0.0	0.0	170005.	45.0	234707.	320700.	442.	1.0083
5	23	144	BAY CITY MI	10645.	10961.	5.2	45.0	78097.	26.2	117602.	136500.	442.	1.0083
5	23	145	DETROIT MI	10645.	10961.	192.0	2000.0	3970584.	872.0	4212192.	5409500.	442.	1.0083
5	23	146	FLINT MI	10645.	10961.	1.1	13.0	330128.	96.4	498109.	685500.	442.	1.0083
5	23	147	GRAND RAPIDS MI	10645.	10961.	4.9	66.0	352703.	146.2	540799.	620500.	442.	1.0331
5	23	148	JACKSON MI	10645.	10961.	4.4	39.0	78572.	36.1	143692.	173900.	442.	1.0083
5	23	149	KALAMAZOO MI	10645.	10961.	0.0	0.0	152083.	73.3	202139.	266400.	442.	1.1570
5	23	150	LANSING MI	10645.	10961.	7.2	85.0	229518.	73.4	379528.	502500.	442.	1.0083
5	23	151	MUSKEGON MI	10645.	10961.	0.0	0.0	105716.	52.3	157000.	174100.	442.	1.0331
5	23	152	SAGINAW MI	10645.	10961.	11.5	103.0	147552.	43.5	220385.	264200.	442.	1.0083
5	23	153	SOUTH BEND METRO MI	10645.	10961.	0.0	0.0	23424.	13.6	280804.	315100.	442.	1.1570
5	23	154	TOLEDO METRO MI	10645.	10961.	1.7	7.0	11861.	6.9	694856.	840900.	442.	1.0083
5	24	155	DULUTH MN	4553.	4577.	2.6	31.0	105639.	71.1	266404.	255900.	256.	0.9091
5	24	156	FARGO METRO MN	4553.	4577.	2.2	22.0	32026.	8.8	120474.	127200.	256.	0.9091
5	24	157	LACROSSE METRO MN	4553.	4577.	0.0	0.0	3142.	2.3	80748.	94200.	256.	0.9091
5	24	158	MINNEAPOLIS MN	4553.	4577.	26.0	326.7	1704423.	721.4	1821710.	2455600.	256.	0.9091
5	24	159	ROCHESTER MN	4553.	4577.	0.0	0.0	56604.	15.2	84470.	120000.	256.	0.9091
5	36	160	AKRON OH	12609.	13202.	13.0	54.2	542775.	203.5	681533.	762900.	142.	1.0744

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EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	STATE POPULATIONS 1990 OMERS 1000 PERSONS	1990 EPA	COM SEWER OVERFLOW AREA 1000 ACRES	POP. 1000 PER	URBANIZED AREA POP.	AREA SQMI	SMSA POPULATIONS 1970	1990	AVG D.A. PER CSO	EPA COST INDEX
5	36	161	CANTON OH	12609.	13202.	0.0	0.0	244279.	77.2	373467.	395600.	142.	1.0083
5	36	162	CINCINNATI OH	12609.	13202.	73.4	778.0	913536.	275.2	1309090.	1635800.	142.	1.0331
5	36	163	CLEVELAND OH	12609.	13202.	39.2	665.0	1959880.	646.1	2071168.	2356900.	142.	1.0744
5	36	164	COLUMBUS OH	12609.	13202.	11.2	175.0	790019.	234.5	919323.	1300000.	142.	1.0331
5	36	165	DAYTON OH	12609.	13202.	0.0	0.0	685942.	224.2	853130.	1050190.	142.	1.0331
5	36	166	HAMILTON OH	12609.	13202.	2.4	35.0	90912.	38.2	226971.	276500.	142.	1.0331
5	36	167	HUNTINGTON METRO OH	12609.	13202.	1.6	12.7	29250.	13.8	254157.	269900.	142.	1.0331
5	36	168	LIMA OH	12609.	13202.	10.1	70.0	70295.	27.4	172051.	197600.	142.	1.0083
5	36	169	LORAIN - ELYRIA OH	12609.	13202.	0.1	5.0	192265.	106.4	257711.	300000.	142.	1.0744
5	36	170	MANSFIELD OH	12609.	13202.	0.0	0.0	77599.	40.9	130436.	155700.	142.	1.0083
5	36	171	SPRINGFIELD OH	12609.	13202.	7.3	72.0	93653.	25.3	157646.	170500.	142.	1.0331
5	36	172	STEUBENVILLE OH	12609.	13202.	4.2	48.0	48262.	12.3	166022.	152100.	142.	1.0413
5	36	173	TOLEDO OH	12609.	13202.	15.9	208.0	475920.	150.6	694056.	840900.	142.	1.0083
5	36	174	WHEELING METRO OH	12609.	13202.	0.7	7.0	32239.	6.9	183088.	172300.	142.	1.0413
5	36	175	YOUNGSTOWN OH	12609.	13202.	13.7	172.0	395540.	128.6	537814.	611500.	142.	1.0744
5	50	176	APPLETON WI	5013.	5218.	2.0	29.0	129532.	37.1	277838.	333900.	84.	1.0331
5	50	177	DULUTH METRO WI	5013.	5218.	0.0	0.0	32713.	39.8	266484.	255500.	84.	0.9091
5	50	178	GREEN BAY WI	5013.	5218.	0.9	10.0	129105.	77.6	158784.	187200.	84.	1.0331
5	50	179	KENOSHA WI	5013.	5218.	1.8	20.0	84282.	17.5	118399.	133400.	84.	1.0331
5	50	180	LA CROSSE WI	5013.	5218.	0.5	6.0	68231.	21.2	80742.	94200.	84.	0.9091
5	50	181	MADISON WI	5013.	5218.	0.0	0.0	205457.	68.8	291262.	434800.	84.	1.0331
5	50	182	MILWAUKEE WI	5013.	5218.	17.8	419.0	1252457.	456.5	1408675.	1525800.	84.	1.0331
5	50	183	OSHKOSH WI	5013.	5218.	0.0	0.0	55480.	12.6	277838.	333900.	84.	1.0331
5	50	184	RACINE WI	5013.	5218.	0.0	0.0	117408.	28.1	171421.	188100.	84.	1.0331
6	4	185	FORT SMITH AR	2271.	2225.	4.3	30.0	73419.	57.0	160099.	199800.	7680.	0.7934
6	4	186	LITTLE ROCK AR	2271.	2225.	0.0	0.0	222616.	95.3	323751.	457500.	7680.	1.1570
6	4	187	PINE BLUFF AR	2271.	2225.	0.0	0.0	60907.	20.8	85449.	107400.	7680.	1.1570
6	4	188	TEXARKANA METRO AR	2271.	2225.	0.0	0.0	21682.	6.8	101592.	123000.	7680.	0.7934
6	19	189	BATON ROUGE LA	3936.	4159.	0.0	0.0	249463.	84.6	285231.	370500.	2000.	0.9256
6	19	190	LAFAYETTE LA	3936.	4159.	0.0	0.0	78544.	24.9	111770.	105800.	2000.	0.9256
6	19	191	LAKE CHARLES LA	3936.	4159.	0.0	0.0	88260.	35.5	145400.	155700.	2000.	0.9256
6	19	192	MONROE LA	3936.	4159.	0.0	0.0	90567.	40.1	115413.	139600.	2000.	0.9256
6	19	193	NEW ORLEANS LA	3936.	4159.	0.0	0.0	961728.	84.0	1046709.	1178100.	2000.	0.9256
6	19	194	SHREVEPORT LA	3936.	4159.	0.0	0.0	234564.	94.3	293953.	335300.	2000.	0.9256
6	32	195	ALBUQUERQUE NM	1131.	1300.	0.0	0.0	297451.	114.0	316700.	422700.	2000.	0.8843
6	37	196	FORT SMITH METRO OK	2993.	2942.	0.0	0.0	2098.	2.7	160844.	199800.	2000.	0.7934
6	37	197	LAWTON OK	2993.	2942.	0.0	0.0	95087.	44.0	108083.	109100.	2000.	0.7934
6	37	198	OKLAHOMA CITY OK	2993.	2942.	0.0	0.0	579788.	339.1	644083.	913300.	2000.	0.7934
6	37	199	TULSA OK	2993.	2942.	0.0	0.0	371499.	180.1	476302.	500000.	2000.	1.0000
6	44	200	ABILENE TX	13580.	15351.	0.0	0.0	90571.	78.4	114542.	117200.	544.	0.7934

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6	44	201	AMARILLO TX	13500.	15351.	0.0	0.0	127010.	60.7	145135.	183300.	544.	0.7934
6	44	202	AUSTIN TX	13500.	15351.	0.0	0.0	264499.	85.8	297027.	431400.	544.	0.8678
6	44	203	BEAUMONT TX	13500.	15351.	2.8	38.6	116350.	74.5	317558.	390000.	544.	0.8678
6	44	204	BROWNSVILLE TX	13500.	15351.	0.0	0.0	52627.	15.2	141086.	147100.	544.	0.8678
6	44	205	BRYAN TX	13500.	15351.	0.0	0.0	51395.	33.4	58275.	103700.	544.	0.8678
6	44	206	CORPUS CHRISTI TX	13500.	15351.	0.0	0.0	212820.	130.3	286289.	317600.	544.	0.8678
6	44	207	DALLAS TX	13500.	15351.	0.0	0.0	1338684.	674.2	1563900.	2190000.	544.	0.7934
6	44	208	EL PASO TX	13500.	15351.	0.0	0.0	337471.	119.4	361120.	360100.	544.	0.7934
6	44	209	FORT WORTH TX	13500.	15351.	0.0	0.0	876944.	398.4	769903.	970400.	544.	0.7934
6	44	210	GALVESTON TX	13500.	15351.	1.1	40.0	61809.	22.5	170681.	237300.	544.	0.8678
6	44	211	HARLINGEN TX	13500.	15351.	0.0	0.0	50469.	33.0	141086.	147100.	544.	0.8678
6	44	212	HOUSTON TX	13500.	15351.	0.0	1.0	1677863.	530.6	1995104.	2873300.	544.	0.8678
6	44	213	LAREDO TX	13500.	15351.	0.0	0.0	70197.	22.1	73232.	77100.	544.	0.8678
6	44	214	LUBBOCK TX	13500.	15351.	0.0	0.0	150135.	76.9	180212.	173000.	544.	0.7934
6	44	215	MCALLEN - PHARR TX	13500.	15351.	0.0	0.0	91181.	32.7	182008.	199400.	544.	0.8678
6	44	216	MIDLAND TX	13500.	15351.	0.0	0.0	60371.	32.0	65768.	64000.	544.	0.7934
6	44	217	ODESSA TX	13500.	15351.	0.0	0.0	81645.	25.1	92275.	89000.	544.	0.7934
6	44	218	PORT ARTHUR TX	13500.	15351.	0.0	0.0	116474.	73.0	317558.	390000.	544.	0.8678
6	44	219	SAN ANGELO TX	13500.	15351.	0.0	0.0	63884.	33.7	71410.	89000.	544.	0.7934
6	44	220	SAN ANTONIO TX	13500.	15351.	0.0	0.0	772513.	222.9	868433.	963100.	544.	0.8678
6	44	221	SHERMAN TX	13500.	15351.	0.0	0.0	55343.	34.5	83051.	105800.	544.	0.7934
6	44	222	TEXARKANA TX	13500.	15351.	0.0	0.0	36880.	24.0	101592.	123000.	544.	0.7934
6	44	223	TEXAS CITY TX	13500.	15351.	0.0	0.0	84054.	82.7	170681.	237300.	544.	0.8678
6	44	224	TYLER TX	13500.	15351.	0.0	0.0	59781.	24.8	97593.	132000.	544.	0.7934
6	44	225	WACO TX	13500.	15351.	0.0	0.0	118843.	89.9	140500.	181500.	544.	0.7934
6	44	226	WICHITA FALLS TX	13500.	15351.	0.0	0.0	97564.	42.2	309166.	366800.	544.	0.7934
7	16	227	CEDAR RAPIDS IA	2993.	3053.	0.0	0.0	132008.	62.0	163500.	195900.	373.	1.1570
7	16	228	DAVENPORT IA	2993.	3053.	0.3	3.0	126295.	82.9	363344.	391900.	373.	1.1570
7	16	229	DES MOINES IA	2993.	3053.	8.0	110.0	255024.	109.1	286004.	359600.	373.	1.1570
7	16	230	DUBUQUE IA	2993.	3053.	0.0	0.0	63143.	17.2	90769.	100200.	373.	1.1570
7	16	231	OMAHA METRO IA	2993.	3053.	0.0	0.0	88887.	41.0	545273.	650500.	373.	1.0000
7	16	232	SIOUX CITY IA	2993.	3053.	0.0	0.0	87157.	56.0	116431.	109400.	373.	0.9091
7	16	233	WATERLOO IA	2993.	3053.	0.0	0.0	112001.	69.4	133150.	140900.	373.	1.1570
7	17	234	KANSAS CITY METRO KS	2281.	2509.	8.0	76.0	350208.	85.9	1259287.	1634800.	381.	1.0000
7	17	235	ST JOSEPH METRO KS	2281.	2509.	0.2	1.1	1283.	1.2	87205.	85300.	381.	1.0000
7	17	236	TOPEKA KS	2281.	2509.	3.7	45.0	132108.	52.8	155248.	196200.	381.	1.0000
7	17	237	WICHITA KS	2281.	2509.	0.0	0.0	302334.	105.1	128275.	125900.	381.	1.0000
7	26	238	COLUMBIA MO	5438.	5488.	0.0	0.0	59231.	42.0	81181.	147800.	415.	1.1570
7	26	239	KANSAS CITY MO	5438.	5488.	21.0	308.0	751579.	487.3	1259287.	1634800.	415.	1.0000
7	26	240	SPRINGFIELD MO	5438.	5488.	0.0	0.0	121340.	63.1	153439.	203600.	415.	1.1570

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7	26	241	ST JOSEPH MO	5430.	5400.	14.2	75.9	75940.	30.7	87205.	85360.	415.	1.0000
7	26	242	ST LOUIS MO	5430.	5400.	112.7	1096.0	1560460.	349.9	2370219.	2716000.	415.	1.1570
7	28	243	LINCOLN NE	1557.	1562.	0.0	0.0	153443.	52.1	160694.	205490.	2000.	1.0000
7	28	244	OMAHA NE	1557.	1562.	20.9	296.0	426929.	110.2	545273.	630500.	2000.	1.0000
7	28	245	SIOUX CITY METRO NE	1557.	1562.	0.0	0.0	7920.	3.6	116031.	109400.	2000.	0.9091
8	6	246	BOULDER CO	2890.	3400.	0.0	0.0	68634.	14.1	1237392.	1783500.	1600.	0.8843
8	6	247	COLORADO SPRINGS CO	2890.	3400.	0.0	0.0	204766.	90.9	237060.	271100.	1600.	0.8843
8	6	248	DENVER CO	2890.	3400.	0.3	0.0	1047311.	292.8	1237392.	1783500.	1600.	0.8843
8	6	249	PUEBLO CO	2890.	3400.	1.2	22.0	103300.	31.5	119100.	130000.	1600.	0.8843
8	27	250	BILLINGS MT	660.	757.	0.0	0.0	71197.	26.9	87692.	99500.	920.	1.0330
8	27	251	GREAT FALLS MT	664.	757.	0.0	0.0	70905.	21.8	82109.	79800.	920.	1.0330
8	35	252	FARGO ND	563.	606.	0.4	4.2	53420.	15.3	120474.	127200.	193.	0.9091
8	42	253	SIOUX CITY METRO SD	647.	683.	0.0	0.0	860.	0.7	116431.	109400.	887.	0.9091
8	42	254	SIOUX FALLS SD	647.	683.	0.2	2.0	75146.	26.9	95173.	110900.	887.	0.9091
8	45	255	OGDEN UT	1310.	1509.	0.0	0.0	149727.	61.0	127057.	160000.	277.	0.8843
8	45	256	PROVO UT	1310.	1509.	0.0	0.0	104110.	65.0	139691.	177300.	277.	0.8843
8	45	257	SALT LAKE CITY UT	1310.	1509.	0.0	0.0	479342.	184.3	562678.	717000.	277.	0.8843
9	3	258	PHOENIX AZ	2701.	3304.	0.0	0.0	863357.	387.5	979151.	1625100.	1786.	1.0578
9	3	259	TUCSON AZ	2701.	3304.	0.0	0.0	294100.	194.7	355530.	503900.	1786.	1.0578
9	5	260	BAKERSFIELD CA	24982.	26601.	0.0	0.0	176155.	57.2	329753.	363200.	1635.	1.0578
9	5	261	FRESNO CA	24982.	26601.	0.0	0.0	282908.	79.1	413590.	445700.	1635.	1.1157
9	5	262	LOS ANGELES CA	24982.	26601.	0.0	0.0	8351266.	1571.9	9607592.	12000400.	1635.	1.0578
9	5	263	MODESTO CA	24982.	26601.	0.0	0.0	106107.	34.3	195159.	230300.	1635.	1.1157
9	5	264	OXNARD CA	24982.	26601.	0.0	0.0	244653.	111.5	379415.	505000.	1635.	1.0578
9	5	265	SACRAMENTO CA	24982.	26601.	5.0	70.0	633732.	244.2	803997.	1006300.	1635.	1.1157
9	5	266	SALINAS CA	24982.	26601.	0.0	0.0	62456.	15.0	248913.	289200.	1635.	1.1157
9	5	267	SAN BERNARDINO CA	24982.	26601.	0.0	0.0	583597.	309.7	1147639.	1481400.	1635.	1.0578
9	5	268	SAN DIEGO CA	24982.	26601.	0.0	0.0	1198323.	380.7	1357482.	1776700.	1635.	1.0578
9	5	269	SAN FRANCISCO CA	24982.	26601.	58.1	1410.0	2987850.	601.[illegible]	3363777.	4155400.	1635.	1.1157
9	5	270	SAN JOSE CA	24982.	26601.	0.0	0.0	1025273.	277.2	1071796.	1680000.	1635.	1.1157
9	5	271	SANTA BARBARA CA	24982.	26601.	0.0	0.0	129774.	[illegible]	264502.	309300.	1635.	1.0578
9	5	272	SANTA ROSA CA	24982.	26601.	0.0	0.0	75083.	38.2	205046.	240600.	1635.	1.1157
9	5	273	SEASIDE CA	24982.	26601.	0.0	0.0	93204.	24.1	200913.	289200.	1635.	1.1157
9	5	274	SIMI VALLEY CA	24982.	26601.	0.0	0.0	56936.	24.8	379415.	505000.	1635.	1.0578
9	5	275	STOCKTON CA	24982.	26601.	0.0	0.0	160373.	46.0	292600.	325700.	1635.	1.1157
9	12	276	HONOLULU HI	979.	1132.	0.0	0.0	442397.	115.0	621269.	841000.	239.	1.7000
9	29	277	LAS VEGAS NV	761.	933.	0.0	0.0	236681.	121.2	273671.	419000.	270.	1.0578
9	29	278	RENO NV	761.	933.	2.4	35.0	99687.	37.5	122124.	199600.	270.	1.1157
10	13	279	BOISE CITY ID	737.	900.	0.0	0.0	85187.	29.4	112059.	139000.	170.	1.0330
10	38	280	EUGENE OR	2537.	2943.	0.0	0.0	139255.	55.3	214440.	263100.	440.	1.0330

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10	38	281	PORTLAND OR	2537.	2943.	24.2	316.0	751756.	236.2	1013780.	1287500.	888.	1.0330
10	38	282	SALEM OR	2537.	2943.	0.0	0.0	93041.	36.8	187605.	239000.	888.	1.0330
10	48	283	PORTLAND METRO WA	3806.	4194.	0.0	0.0	73170.	30.6	1013780.	1287500.	728.	1.0330
10	48	284	SEATTLE WA	3806.	4194.	37.9	463.0	1238107.	413.1	1423885.	1690900.	728.	1.0330
10	48	285	SPOKANE WA	3806.	4194.	19.4	165.0	229620.	77.8	287894.	319400.	728.	1.0330
10	48	286	TACOMA WA	3806.	4194.	0.0	0.3	332521.	128.7	411610.	409600.	728.	1.0330
4	10	287	MELBOURNE - COCOA FL	10978.	11728.	0.0	0.0	178988.	106.8	230800.	398000.	88.	0.8843
4	10	288	SARASOTA-BRADENTON F	10978.	11728.	0.0	0.0	167298.	91.6	121658.	260900.	88.	0.8843
4	10	289	DAYTONA BEACH FL	10978.	11728.	0.0	0.0	115176.	85.0	170922.	236500.	88.	0.8843
1	7	290	NEW LONDON-NORWICH C	3710.	3986.	0.0	0.0	139121.	75.4	231170.	270800.	310.	1.3223
4	34	291	GASTONIA NC	6465.	5880.	0.0	0.0	94725.	58.5	148676.	180500.	1970.	0.6281
10	48	292	RICHLAND-KENNEWICK W	3806.	4194.	0.0	0.0	71285.	56.8	93489.	110000.	728.	1.0330
2	33	293	POUGHKEEPSIE NY	20986.	21799.	0.0	0.0	102649.	54.7	222523.	306800.	208.	1.3223
10	2	294	ANCHORAGE AK	391.	408.	0.0	0.0	110782.	54.5	178132.	259200.	1560.	1.0330
4	43	295	KINGSPORT TN	5190.	4800.	0.0	0.0	66266.	46.5	372876.	507100.	322.	1.0331
3	47	296	KINGSPORT METRO VA	6135.	5958.	0.8	2.3	4876.	2.2	372876.	507100.	173.	1.0331
4	10	297	FORT MYERS FL	10978.	11728.	0.0	0.0	69129.	43.4	107039.	214900.	88.	0.8843
4	1	298	FLORENCE AL	4090.	3850.	0.0	0.0	62926.	42.0	117976.	155700.	952.	0.8264
5	14	299	ALTON IL	13056.	13177.	3.3	11.9	95998.	41.5	2370219.	2716800.	358.	1.1570
6	44	300	KILLEEN TX	13580.	15351.	0.0	0.0	73585.	40.3	160612.	166200.	548.	0.7934
4	43	301	CLARKSVILLE TN	5190.	4800.	0.0	0.0	44729.	33.7	118985.	161800.	322.	0.8264
4	18	302	CLARKSVILLE METRO KY	3982.	3741.	0.0	0.0	13616.	6.2	118985.	161800.	103.	0.8264
4	1	303	ANNISTON AL	4090.	3850.	0.0	0.0	58851.	37.4	103092.	130900.	952.	0.8264
6	19	304	ALEXANDRIA LA	3936.	4159.	0.0	0.0	77609.	37.1	118105.	133800.	2941.	0.9256
4	41	305	SPARTANBURG SC	3122.	3023.	0.0	0.0	73638.	36.1	174092.	229400.	952.	0.6281
9	5	306	SANTA CRUZ CA	24982.	26601.	0.0	0.0	73758.	34.4	124007.	151800.	1635.	1.1157
5	23	307	BATTLE CREEK MI	10645.	10961.	0.0	0.0	77922.	31.1	142378.	173000.	442.	1.1570
4	34	308	BURLINGTON NC	6465.	5880.	0.0	0.0	59891.	30.7	96362.	130100.	1970.	0.6281
4	10	309	LAKELAND FL	10978.	11728.	0.0	0.0	66739.	27.3	229098.	339600.	88.	0.8843
2	33	310	ELMIRA NY	20986.	21799.	0.0	0.0	74039.	23.8	101641.	111190.	208.	1.3223
9	5	311	ANTIOCH-PITTSBURG CA	24982.	26601.	0.0	0.0	59585.	22.3	3111866.	3839200.	1635.	1.1157
10	48	312	YAKIMA WA	3806.	4194.	0.0	0.0	64730.	22.2	145176.	143700.	728.	1.0330
3	39	313	WILLIAMSPORT PA	13416.	13342.	0.0	0.0	63880.	21.7	114089.	119509.	141.	1.0826
3	49	314	PARKERSBURG WV	1845.	1845.	0.0	0.0	57821.	17.1	144259.	201500.	75.	1.0413
5	36	315	PARKERSBURG METRO OH	12609.	13202.	0.0	0.0	7189.	3.2	144259.	201508.	142.	1.0413
5	24	316	ST CLOUD MN	4553.	4577.	0.0	0.0	52059.	18.8	134585.	164300.	256.	0.9091
2	53	317	CAGUAS PR	3777.	3786.	0.0	0.0	65844.	8.5	95661.	133213.	3000.	1.3223
2	53	318	MAYAGUEZ PR	3777.	3786.	0.0	0.0	69558.	14.3	85857.	119568.	3000.	1.3223
2	53	319	PONCE PR	3777.	3786.	0.0	0.0	128233.	17.0	158981.	221389.	3000.	1.3223
2	53	320	SAN JUAN PR	3777.	3786.	2.8	93.0	820442.	102.5	851287.	1185406.	3000.	1.3223

BASE DATA
EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

PA NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
1	7	1	BRIDGEPORT CT	119.	42.01	0.	100.	15	1
1	7	2	BRISTOL CT	128.	42.03	39.	100.	1	2
1	7	3	DANBURY CT	119.	42.01	80.	100.	1	3
1	7	4	HARTFORD CT	128.	42.43	6800.	80.	3	4
1	7	5	MERIDEN CT	128.	44.14	134.	100.	2	5
1	7	6	NEW BRITAIN CT	128.	42.43	32.	80.	1	6
1	7	7	NEW HAVEN CT	131.	48.99	106.	100.	12	7
1	7	8	NORWALK CT	119.	42.01	22.	100.	15	8
1	7	9	SPRINGFIELD METRO CT	128.	45.11	5100.	100.	3	9
1	7	10	STAMFORD CT	119.	42.01	0.	100.	3	10
1	7	11	WATERBURY CT	128.	47.26	65.	100.	2	11
1	20	12	LEWISTON - AUBURN ME	125.	43.58	3200.	100.	3	12
1	20	13	PORTLAND ME	125.	42.85	0.	100.	14	13
1	22	14	BOSTON MA	128.	42.77	100.	100.	10	14
1	22	15	BROCKTON MA	135.	40.96	2.	10.	1	15
1	22	16	FALL RIVER MA	123.	45.28	220.	100.	9	16
1	22	17	FITCHBURG MA	129.	45.74	78.	100.	1	17
1	22	18	LAWRENCE MA	128.	40.96	2800.	100.	3	18
1	22	19	LOWELL MA	128.	43.34	2400.	100.	3	19
1	22	20	NEW BEDFORD MA	123.	41.05	0.	100.	15	20
1	22	21	PITTSFIELD MA	152.	44.42	46.	90.	1	21
1	22	22	PROVIDENCE METRO MA	123.	39.63	270.	100.	9	22
1	22	23	SPRINGFIELD MA	128.	45.11	5100.	100.	3	23
1	22	24	WORCESTER MA	129.	45.41	20.	30.	1	24
1	30	25	LAWRENCE METRO NH	128.	40.96	2800.	100.	3	25
1	30	26	MANCHESTER NH	120.	43.20	1700.	100.	3	26
1	30	27	NASHUA NH	120.	42.13	1700.	100.	3	27
1	40	28	FALL RIVER METRO RI	123.	45.28	220.	100.	9	28
1	40	29	PROVIDENCE RI	123.	39.63	270.	100.	9	29
2	31	30	ALLENTOWN METRO NJ	122.	44.12	1300.	100.	3	30
2	31	31	ATLANTIC CITY NJ	112.	43.78	0.	100.	15	31
2	31	32	NEW YORK CITY MTR NJ	119.	42.38	5200.	100.	14	32
2	31	33	PHILADELPHIA MTR NJ	115.	42.48	7000.	100.	12	33
2	31	34	TRENTON NJ	121.	41.28	5700.	100.	5	34
2	31	35	VINELAND NJ	115.	43.74	105.	100.	2	35
2	31	36	WILMINGTON METRO NJ	127.	44.36	7200.	100.	11	36
2	33	37	ALBANY NY	133.	37.95	4820.	100.	4	37
2	33	38	BINGHAMPTON NY	133.	36.28	669.	100.	4	38
2	33	39	BUFFALO NY	165.	35.65	160000.	100.	5	39
2	33	40	NEW YORK CITY NY	119.	42.37	5200.	60.	14	40

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EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

A NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
2	33	41	ROCHESTER NY	153.	31.50	500.	100.	8	41
2	33	42	SYRACUSE NY	167.	37.60	21.	60.	1	42
2	33	43	UTICA - ROME NY	167.	39.73	900.	100.	3	43
3	8	44	WILMINGTON DE	127.	44.36	7200.	100.	11	44
3	9	45	WASHINGTON DC	111.	40.78	3400.	100.	10	45
3	21	46	BALTIMORE MD	112.	44.21	134.	100.	12	46
3	21	47	WASHINGTON DC MTR MD	111.	40.78	3400.	100.	10	47
3	39	48	ALLENTOWN PA	122.	44.12	1300.	100.	3	48
3	39	49	ALTOONA PA	142.	43.83	134.	100.	1	49
3	39	50	ERIE PA	157.	37.50	0.	100.	15	50
3	39	51	HARRISBURG PA	124.	37.65	9950.	100.	4	51
3	39	52	JOHNSTOWN PA	150.	44.77	520.	100.	2	52
3	39	53	LANCASTER PA	124.	43.29	210.	65.	2	53
3	39	54	PHILADELPHIA PA	115.	42.48	7000.	100.	12	54
3	39	55	PITTSBURGH PA	146.	36.87	12000.	100.	4	55
3	39	56	READING PA	120.	41.43	1020.	100.	3	56
3	39	57	SCRANTON PA	137.	38.48	130.	100.	1	57
3	39	58	TRENTON METRO PA	121.	41.28	5700.	100.	5	58
3	39	59	WILKES-BARRE PA	137.	39.37	2750.	100.	3	59
3	39	60	YORK PA	124.	42.00	100.	80.	1	60
3	47	61	LYNCHBURG VA	119.	40.30	830.	100.	3	61
3	47	62	NEWPORT NEWS VA	114.	41.95	1000.	100.	12	62
3	47	63	NORFOLK VA	114.	44.94	1000.	100.	12	63
3	47	64	PETERSBURG VA	113.	44.21	116.	100.	2	64
3	47	65	RICHMOND VA	113.	48.21	865.	100.	3	65
3	47	66	ROANOKE VA	120.	43.12	170.	100.	1	66
3	47	67	WASHINGTON DC/MTR VA	107.	40.78	3400.	100.	10	67
3	49	68	CHARLESTON WV	152.	42.36	7600.	100.	4	68
3	49	69	HUNTINGTON WV	136.	41.79	44000.	100.	5	69
3	49	70	STEUBENVILLE MTR WV	146.	40.83	13500.	100.	4	70
3	49	71	WHEELING WV	146.	38.95	13500.	100.	4	71
4	1	72	BIRMINGHAM AL	118.	53.52	40.	30.	1	72
4	1	73	COLUMBUS METRO AL	110.	48.67	4120.	100.	6	73
4	1	74	GADSDEN AL	118.	54.95	3820.	100.	3	74
4	1	75	HUNTSVILLE AL	118.	52.07	32000.	100.	5	75
4	1	76	MOBILE AL	123.	67.57	17000.	100.	11	76
4	1	77	MONTGOMERY AL	113.	53.66	8000.	100.	4	77
4	1	78	TUSCALOOSA AL	118.	52.77	1900.	100.	3	78
4	10	79	FT LAUDERDALE FL	127.	60.29	0.	100.	15	79
4	10	80	GAINESVILLE FL	116.	52.45	0.	100.	7	80

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EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
4	10	81	JACKSONVILLE FL	116.	53.36	2500.	100.	10	81
4	10	82	MIAMI FL	127.	57.48	0.	100.	15	82
4	10	83	ORLANDO FL	119.	51.37	10.	40.	7	83
4	10	84	PENSACOLA FL	119.	62.87	3500.	100.	10	84
4	10	85	ST PETERSBURG FL	108.	55.41	150.	100.	14	85
4	10	86	TALLAHASSEE FL	119.	56.46	500.	80.	6	86
4	10	87	TAMPA FL	108.	51.57	150.	100.	10	87
4	10	88	WEST PALM BEACH FL	131.	61.70	0.	100.	15	88
4	11	89	ALBANY GA	110.	47.84	2240.	100.	4	89
4	11	90	ATLANTA GA	115.	47.14	1700.	70.	3	90
4	11	91	AUGUSTA GA	105.	39.18	6800.	100.	6	91
4	11	92	CHATTANOOGA METRO GA	131.	53.60	30000.	100.	6	92
4	11	93	COLUMBUS GA	110.	48.67	4126.	100.	6	93
4	11	94	MACON GA	112.	44.08	950.	100.	5	94
4	11	95	SAVANNAH GA	110.	49.91	7560.	100.	10	95
4	18	96	CINCINNATI METRO KY	134.	39.34	36000.	100.	5	96
4	18	97	HUNTINGTON METRO KY	136.	41.79	40000.	100.	5	97
4	18	98	LEXINGTON KY	133.	43.71	5.	40.	1	98
4	18	99	LOUISVILLE KY	122.	41.47	39000.	100.	5	99
4	18	100	OWENSBORO KY	115.	44.29	30000.	100.	5	100
4	25	101	BILOXI - GULFPORT MS	123.	57.59	0.	100.	15	101
4	25	102	JACKSON MS	107.	50.86	320.	70.	3	102
4	25	103	MEMPHIS METRO MS	112.	46.81	305300.	100.	5	103
4	34	104	ASHEVILLE NC	127.	37.88	1350.	100.	2	104
4	34	105	CHARLOTTE NC	118.	43.38	30.	25.	1	105
4	34	106	DURHAM NC	113.	42.65	7.	40.	1	106
4	34	107	FAYETTEVILLE NC	113.	46.44	1200.	100.	3	107
4	34	108	GREENSBORO NC	117.	42.16	40.	40.	1	108
4	34	109	HIGHPOINT NC	117.	45.60	6.	20.	1	109
4	34	110	RALEIGH NC	113.	46.20	224.	90.	2	110
4	34	111	WILMINGTON NC	115.	51.29	2000.	100.	11	111
4	34	112	WINSTON-SALEM NC	117.	45.69	30.	70.	1	112
4	41	113	AUGUSTA METRO SC	105.	39.18	6800.	100.	4	113
4	41	114	CHARLESTON SC	115.	46.54	0.	100.	12	114
4	41	115	COLUMBIA SC	109.	46.82	4000.	100.	4	115
4	41	116	GREENVILLE SC	112.	46.42	50.	95.	2	116
4	43	117	CHATTANOOGA TN	131.	53.60	30000.	100.	6	117
4	43	118	KNOXVILLE TN	132.	45.51	10403.	100.	4	118
4	43	119	MEMPHIS TN	112.	46.81	305300.	100.	5	119
4	43	120	NASHVILLE TN	120.	45.40	10500.	100.	4	120

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EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
5	14	121	AURORA IL	120.	33.80	950.	100.	3	121
5	14	122	BLOOMINGTON IL	109.	36.20	110.	90.	2	122
5	14	123	CHAMPAIGN IL	112.	37.00	3.	20.	1	123
5	14	124	CHICAGO IL	120.	33.49	0.	100.	6	124
5	14	125	DAVENPORT METRO IL	110.	33.08	25500.	100.	5	125
5	14	126	DECATUR IL	112.	37.13	330.	100.	3	126
5	14	127	DUBUQUE METRO IL	109.	35.71	22000.	100.	4	127
5	14	128	JOLIET IL	120.	33.80	2500.	100.	3	128
5	14	129	PEORIA IL	109.	34.88	8800.	100.	3	129
5	14	130	ROCKFORD IL	112.	35.62	2700.	100.	3	130
5	14	131	SPRINGFIELD IL	112.	34.83	330.	100.	3	131
5	14	132	ST LOUIS METRO IL	104.	36.46	123000.	100.	5	132
5	15	133	ANDERSON IN	124.	36.71	140.	100.	2	133
5	15	134	CHICAGO METRO IN	120.	33.49	0.	100.	6	134
5	15	135	EVANSVILLE IN	115.	41.37	84300.	100.	4	135
5	15	136	FORT WAYNE IN	129.	34.21	140.	100.	2	136
5	15	137	INDIANAPOLIS IN	124.	39.69	400.	100.	2	137
5	15	138	LAFAYETTE IN	124.	36.06	2800.	100.	3	138
5	15	139	LOUISVILLE METRO IN	122.	41.47	39000.	100.	5	139
5	15	140	MUNCIE IN	124.	39.11	50.	100.	1	140
5	15	141	SOUTH BEND IN	136.	35.59	1700.	100.	3	141
5	15	142	TERRA HAUTE IN	124.	41.66	4900.	100.	3	142
5	23	143	ANN ARBOR MI	130.	30.67	230.	100.	2	143
5	23	144	BAY CITY MI	129.	26.73	1200.	100.	8	144
5	23	145	DETROIT MI	130.	30.95	10000.	100.	8	145
5	23	146	FLINT MI	129.	30.14	230.	100.	2	146
5	23	147	GRAND RAPIDS MI	137.	31.19	1050.	100.	3	147
5	23	148	JACKSON MI	137.	31.15	70.	90.	2	148
5	23	149	KALAMAZOO MI	137.	34.08	700.	100.	3	149
5	23	150	LANSING MI	137.	31.18	340.	100.	2	150
5	23	151	MUSKEGON MI	140.	30.07	1390.	100.	8	151
5	23	152	SAGINAW MI	129.	28.04	1200.	100.	2	152
5	23	153	SOUTH BEND METRO MI	136.	35.59	1700.	100.	2	153
5	23	154	TOLEDO METRO MI	131.	31.84	1100.	100.	8	154
5	24	155	DULUTH MN	135.	28.97	1400.	100.	8	155
5	24	156	FARGO METRO MN	106.	18.73	180.	100.	2	156
5	24	157	LACROSSE METRO MN	112.	28.92	12500.	100.	4	157
5	24	158	MINNEAPOLIS MN	113.	24.78	5200.	100.	4	158
5	24	159	ROCHESTER MN	115.	28.46	100.	100.	2	159
5	36	160	AKRON OH	141.	37.26	190.	85.	4	160

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EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
5	36	161	CANTON OH	141.	37.26	130.	90.	3	161
5	36	162	CINCINNATI OH	134.	39.34	36000.	100.	6	162
5	36	163	CLEVELAND OH	156.	32.00	0.	100.	8	163
5	36	164	COLUMBUS OH	140.	34.36	540.	100.	6	164
5	36	165	DAYTON OH	132.	35.15	780.	85.	4	165
5	36	166	HAMILTON OH	134.	39.85	1100.	100.	4	166
5	36	167	HUNTINGTON METRO OH	136.	41.79	48000.	100.	6	167
5	36	168	LIMA OH	132.	36.28	40.	100.	6	168
5	36	169	LORAIN - ELYRIA OH	156.	34.03	0.	100.	8	169
5	36	170	MANSFIELD OH	141.	33.93	2.	100.	1	170
5	36	171	SPRINGFIELD OH	132.	38.07	300.	100.	3	171
5	36	172	STEUBENVILLE OH	146.	40.83	13500.	100.	6	172
5	36	173	TOLEDO OH	131.	31.84	0.	100.	8	173
5	36	174	WHEELING METRO OH	146.	38.95	13500.	100.	6	174
5	36	175	YOUNGSTOWN OH	166.	41.33	470.	100.	6	175
5	50	176	APPLETON WI	121.	28.23	1950.	100.	3	176
5	50	177	DULUTH METRO WI	135.	28.97	1400.	100.	8	177
5	50	178	GREEN BAY WI	121.	26.51	1950.	100.	8	178
5	50	179	KENOSHA WI	114.	31.95	0.	100.	8	179
5	50	180	LA CROSSE WI	112.	28.92	12500.	100.	4	180
5	50	181	MADISON WI	115.	30.71	60.	100.	6	181
5	50	182	MILWAUKEE WI	119.	27.57	170.	100.	8	182
5	50	183	OSHKOSH WI	121.	28.12	1800.	100.	8	183
5	50	184	RACINE WI	119.	31.95	0.	100.	8	184
6	4	185	FORT SMITH AR	93.	42.22	14000.	100.	4	185
6	4	186	LITTLE ROCK AR	102.	48.66	17000.	100.	4	186
6	4	187	PINE BLUFF AR	102.	52.13	17800.	100.	4	187
6	4	188	TEXARKANA METRO AR	98.	49.19	0.	100.	2	188
6	19	189	BATON ROUGE LA	106.	59.13	280000.	100.	5	189
6	19	190	LAFAYETTE LA	107.	59.13	100.	100.	6	190
6	19	191	LAKE CHARLES LA	107.	57.02	420.	100.	3	191
6	19	192	MONROE LA	90.	51.29	3400.	100.	3	192
6	19	193	NEW ORLEANS LA	120.	63.54	320000.	50.	5	193
6	19	194	SHREVEPORT LA	90.	45.10	6600.	100.	4	194
6	32	195	ALBUQUERQUE NM	58.	8.13	150.	100.	2	195
6	37	196	FORT SMITH METRO OK	93.	42.22	14000.	100.	4	196
6	37	197	LAWTON OK	82.	30.18	3.	100.	2	197
6	37	198	OKLAHOMA CITY OK	82.	32.58	2.	65.	2	198
6	37	199	TULSA OK	90.	37.08	3700.	100.	4	199
6	44	200	ABILENE TX	65.	23.32	0.	100.	2	200

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6	44	201	AMARILLO TX	66.	19.67	0.	20.	2	201
6	44	202	AUSTIN TX	81.	32.58	185.	95.	6	202
6	44	203	BEAUMONT TX	103.	54.29	60.	75.	12	203
6	44	204	BROWNSVILLE TX	71.	26.75	713.	100.	4	204
6	44	205	BRYAN TX	76.	40.76	0.	25.	2	205
6	44	206	CORPUS CHRISTI TX	75.	28.34	130.	100.	10	206
6	44	207	DALLAS TX	80.	34.55	10.	100.	4	207
6	44	208	EL PASO TX	68.	7.89	190.	100.	2	208
6	44	209	FORT WORTH TX	79.	31.33	25.	100.	2	209
6	44	210	GALVESTON TX	96.	45.21	0.	100.	15	210
6	44	211	HARLINGEN TX	71.	26.09	700.	100.	4	211
6	44	212	HOUSTON TX	103.	45.26	67.	80.	3	212
6	44	213	LAREDO TX	79.	18.63	1847.	100.	3	213
6	44	214	LUBBOCK TX	60.	17.67	0.	100.	2	214
6	44	215	MCALLEN - PHARR TX	71.	19.29	1800.	100.	3	215
6	44	216	MIDLAND TX	50.	14.24	6.	100.	1	216
6	44	217	ODESSA TX	50.	14.24	0.	100.	1	217
6	44	218	PORT ARTHUR TX	103.	55.35	1860.	100.	7	218
6	44	219	SAN ANGELO TX	55.	18.63	1.	100.	2	219
6	44	220	SAN ANTONIO TX	79.	27.84	17.	85.	2	220
6	44	221	SHERMAN TX	80.	39.05	4.	70.	2	221
6	44	222	TEXARKANA TX	98.	49.19	0.	100.	2	222
6	44	223	TEXAS CITY TX	96.	45.21	0.	100.	10	223
6	44	224	TYLER TX	80.	46.78	9.	40.	2	224
6	44	225	WACO TX	76.	32.08	480.	80.	3	225
6	44	226	WICHITA FALLS TX	69.	26.20	55.	100.	2	226
7	16	227	CEDAR RAPIDS IA	91.	33.82	1200.	100.	3	227
7	16	228	DAVENPORT IA	110.	33.88	25500.	100.	4	228
7	16	229	DES MOINES IA	105.	31.06	2200.	100.	3	229
7	16	230	DUBUQUE IA	109.	35.71	22000.	100.	4	230
7	16	231	OMAHA METRO IA	98.	25.90	20000.	100.	4	231
7	16	232	SIOUX CITY IA	98.	24.77	19200.	100.	4	232
7	16	233	WATERLOO IA	91.	31.40	1060.	100.	3	233
7	17	234	KANSAS CITY METRO KS	98.	34.07	31700.	100.	4	234
7	17	235	ST JOSEPH METRO KS	95.	34.18	27000.	100.	4	235
7	17	236	TOPEKA KS	95.	33.28	1080.	100.	3	236
7	17	237	WICHITA KS	76.	30.70	200.	100.	2	237
7	26	238	COLUMBIA MO	107.	36.96	30.	70.	1	238
7	26	239	KANSAS CITY MO	98.	34.07	31700.	100.	4	239
7	26	240	SPRINGFIELD MO	106.	41.08	73.	25.	1	240

BASE DATA
EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA NO.	STATE NO.	NO.	URBANIZED AREA NAME	NO. STORMS PER YEAR	AVERAGE YEARLY RAIN	STREAMFLOW CFS	PER CENT UA DRAINED STREAM	STREAM CLASSIFICATION	NO.
7	26	241	ST JOSEPH MO	95.	34.18	27000.	100.	4	241
7	26	242	ST LOUIS MO	104.	36.46	123000.	100.	5	242
7	28	243	LINCOLN NE	93.	25.73	70.	100.	2	243
7	28	244	OMAHA NE	98.	25.90	20000.	100.	4	244
7	28	245	SIOUX CITY METRO NE	98.	24.77	19200.	100.	4	245
8	6	246	BOULDER CO	87.	14.57	25.	90.	1	246
8	6	247	COLORADO SPRINGS CO	86.	13.19	6.	100.	1	247
8	6	248	DENVER CO	87.	12.89	114.	100.	2	248
8	6	249	PUEBLO CO	70.	11.84	244.	100.	2	249
8	27	250	BILLINGS MT	93.	13.23	3100.	100.	2	250
8	27	251	GREAT FALLS MT	99.	14.07	6300.	100.	4	251
8	35	252	FARGO ND	106.	19.73	180.	100.	2	252
8	42	253	SIOUX CITY METRO SD	98.	24.77	19200.	100.	4	253
8	42	254	SIOUX FALLS SD	93.	25.24	42.	100.	2	254
8	45	255	OGDEN UT	87.	17.07	233.	100.	2	255
8	45	256	PROVO UT	87.	13.20	10.	100.	4	256
8	45	257	SALT LAKE CITY UT	87.	14.74	118.	100.	2	257
9	3	258	PHOENIX AZ	34.	7.42	510.	100.	2	258
9	3	259	TUCSON AZ	50.	10.47	0.	100.	1	259
9	5	260	BAKERSFIELD CA	37.	6.36	500.	100.	3	260
9	5	261	FRESNO CA	43.	11.14	960.	100.	2	261
9	5	262	LOS ANGELES CA	35.	14.68	0.	100.	15	262
9	5	263	MODESTO CA	63.	12.17	414.	100.	2	263
9	5	264	OXNARD CA	35.	14.75	0.	100.	15	264
9	5	265	SACRAMENTO CA	57.	18.02	15000.	100.	4	265
9	5	266	SALINAS CA	62.	14.14	56.	100.	1	266
9	5	267	SAN BERNARDINO CA	35.	17.71	50.	100.	2	267
9	5	268	SAN DIEGO CA	42.	10.40	0.	100.	15	268
9	5	269	SAN FRANCISCO CA	67.	20.78	13000.	100.	12	269
9	5	270	SAN JOSE CA	63.	13.11	17.	100.	10	270
9	5	271	SANTA BARBARA CA	35.	17.63	0.	100.	15	271
9	5	272	SANTA ROSA CA	67.	29.25	0.	100.	15	272
9	5	273	SEASIDE CA	62.	14.14	0.	100.	15	273
9	5	274	SIMI VALLEY CA	35.	14.22	0.	100.	15	274
9	5	275	STOCKTON CA	50.	14.31	1600.	100.	4	275
9	12	276	HONOLULU HI	99.	23.96	0.	100.	15	276
9	29	277	LAS VEGAS NV	25.	4.35	79.	100.	2	277
9	29	278	RENO NV	47.	6.96	270.	100.	2	278
10	13	279	BOISE CITY ID	91.	11.43	140.	100.	2	279
10	38	280	EUGENE OR	143.	37.51	2440.	100.	4	280

```
                                         BASE DATA
                            EPA 1976 NEEDS SURVEY CATEGORIES 5 & 6

EPA STATE NO. URBANIZED AREA NAME    NO. STORMS     AVERAGE      STREAMFLOW     PER CENT UA    STREAM             NO.
NO.  NO.                              PER YEAR    YEARLY RAIN       CFS        DRAINED STREAM  CLASSIFICATION

 10   38 281  PORTLAND OR                149.        39.91       120000.          100.           5                281
 10   38 282  SALEM OR                   151.        39.85         9500.          100.           4                282
 10   48 283  PORTLAND METRO WA          149.        39.80       120000.          100.           5                283
 10   48 284  SEATTLE WA                 164.        34.10          200.          100.           9                284
 10   48 285  SPOKANE WA                 118.        17.19         1800.          100.           3                285
 10   48 286  TACOMA WA                  163.        40.50          200.          100.           9                286
  4   10 287  MELBOURNE - COCOA FL       115.        55.96            0.          100.          15                287
  4   10 288  SARASOTA-BRADENTON F       108.        55.41            0.          100.          15                288
  4   10 289  DAYTONA BEACH FL           115.        49.90            0.          100.          15                289
  1    7 290  NEW LONDON-NORWICH C       126.        50.88          417.          100.          10                290
  4   34 291  GASTONIA NC                110.        47.38          530.          100.           2                291
 10   48 292  RICHLAND-KENNEWICK W       106.         7.49        81100.          100.           5                292
  2   33 293  POUGHKEEPSIE NY            133.        40.21         4800.          100.           5                293
 10    2 294  ANCHORAGE AK               126.        14.71         1240.          100.          14                294
  4   43 295  KINGSPORT TN               132.        42.34         2065.          100.           3                295
  3   47 296  KINGSPORT METRO VA         132.        42.34         2065.          100.           3                296
  4   10 297  FORT MYERS FL              115.        53.34          500.          100.          11                297
  4    1 298  FLORENCE AL                118.        49.92        32700.          100.           6                298
  5   14 299  ALTON IL                   104.        41.22        64000.          100.           5                299
  6   44 300  KILLEEN TX                  76.        33.94           50.          100.           2                300
  4   43 301  CLARKSVILLE TN             120.        47.46        11600.          100.           4                301
  4   18 302  CLARKSVILLE METRO KY       120.        47.46        11600.          100.           4                302
  4    1 303  ANNISTON AL                118.        51.48          201.          100.           2                303
  6   19 304  ALEXANDRIA LA              106.        63.28         9340.          100.           4                304
  4   41 305  SPARTANBURG SC             112.        49.69           35.           20.           1                305
  9    5 306  SANTA CRUZ CA               67.        31.25            0.          100.          15                306
  5   23 307  BATTLE CREEK MI            137.        33.09          470.          100.           3                307
  4   34 308  BURLINGTON NC              117.        44.95          207.          100.           2                308
  4   10 309  LAKELAND FL                121.        51.37            0.          100.           7                309
  2   33 310  ELMIRA NY                  161.        34.89          170.          100.           3                310
  9    5 311  ANTIOCH-PITTSBURG CA        63.        13.34        13000.          100.          11                311
 10   48 312  YAKIMA WA                   70.         7.86         1870.          100.           3                312
  3   39 313  WILLIAMSPORT PA            142.        40.65         2700.          100.           3                313
  3   49 314  PARKERSBURG WV             143.        39.11        44000.          100.           5                314
  5   36 315  PARKERSBURG METRO OH       143.        39.11        44000.          100.           5                315
  5   24 316  ST CLOUD MN                109.        25.92         3000.          100.           4                316
  2   53 317  CAGUAS PR                  150.        65.61           77.          100.           2                317
  2   53 318  MAYAGUEZ PR                150.        76.12            0.          100.          15                318
  2   53 319  PONCE PR                    99.        36.53         1000.           50.           4                319
  2   53 320  SAN JUAN PR                208.        64.21            0.          100.          10                320

                                 END
```

APPENDIX C

NEEDS ESTIMATION MODEL FOR URBAN RUNOFF

COMPUTER CODE

```
      C
      C          NEMUR  - NEEDS ESTIMATION MODEL FOR URBAN RUNOFF
      C
      C   DEVELOPED BY JORDAN,JONES AND GOULDING, INC.
      C   FOR THE U. S. ENVIRONMENTAL PROTECTION AGENCY
      C   UNDER CONTRACT NO. 68-01-1984   OCTOBER 1976
      C
      C   THIS PROGRAM ESTIMATES THE NEEDS FOR CONTROL AND/OR TREATMENT OF COMBINED
      C   SEWER OVERFLOWS AND STORMWATER DISCHARGES IN ALL URBANIZED AREAS OF THE
      C   U. S.  BOTH CAPITAL AND OPERATION & MAINTENANCE COSTS ARE ESTIMATED
      C   AND SUMMARIZED ON A STATE-BY-STATE AND NATIONAL BASIS.
      C
      C      *INPUT DATA REQUIRED*
      C  N                 NUMBER OF URBANIZED AREAS
      C  ND(1,N)           EPA REGIONAL CODE
      C  ND(2,N)           TWO DIGIT STATE CODE  1-50
      C  ND(3,N)           URBANIZED AREA CODE NUMBER  1-N
      C  ALPHA(5,N)        URBANIZED AREA NAME
      C  BETA(1,N)         1990 STATE POPULATIONS -FROM OBERS PROJECTIONS
      C  BETA(2,N)         1990 STATE POPULATIONS -EPA CEILING
      C  BETA(3,N)         COMBINED SEWER OVERFLOW AREA -1000 ACRES
      C  BETA(4,N)         COMBINED SEWER OVERFLOW POPULATIONS -1000 PEOPLE
      C  BETA(5,N)         URBANIZED AREA POPULATIONS - 1970
      C  BETA(6,N)         URBANIZED AREA SQUARE MILES -1970
      C  BETA(7,N)         1970 SMSA POPULATIONS -OBERS
      C  BETA(8,N)         1990 SMSA POPULATIONS -OBERS
      C  BETA(9,N)         AVERAGE DRAINAGE AREA PER COMBINED SEWER OVERFLOW
      C
      C  RAIN(1,N)         NUMBER OF DAYS WITH MEASUREABLE RAIN PER YEAR
      C  RAIN(2,N)         AVERAGE YEARLY RAINFALL
      C
      C  STR(1,N)          RECEIVING WATER FLOW IN CFS
      C  STR(2,N)          PER CENT OF URBANIZED AREA DRAINED BY THE ABOVE STREAM
      C
      C  CLAS(1,N)         RECEIVING STREAM CLASSIFICATION
      C  CLAS(2,N)         URBANIZED AREA NUMBER
      C  CLAS(3,N)         INDICATES IF URBANIZED AREA IN ADJACENT TO ANOTHER U.A.
      C
      C        *VARIABLES COMPUTED IN NEMUR *
      C
      C    *CATEGORY FIVE VARIABLES*
      C
      C PDCS - POPULATION DENSITY IN COMBINED SEWER AREA
      C CSI  - PER CENT IMPERVIOUSNESS IN COMBINED SEWER AREA
      C RNC  - RUNOFF COEFFICIENT
      C MNS  - MEAN NUMBER OF STORMS PER YEAR
      C MRF  - MEAN RAINFALL PER STORM
      C DS   - DESIGN STORM
      C DVCS - DESIGN VOLUME FOR COMBINED SEWER AREA
      C NTP  - NUMBER OF TREATMENT PLANTS PER URBANIZED AREA
      C NSP  - NUMBER OF STORAGE FACILITIES
      C CTR  - TREATMENT RATE OF THE COMBINED SEWER TREATMENT PLANT
      C TRCS - TREATMENT RATE OF THE COMBINED SEWER STORAGE FACILITY
```

```
              C STCS - STORAGE REQUIRED PER STORAGE FACILITY
              C RF   - REMOVAL FACTOR USED IN COMPUTING PER CENT BOD REMOVAL REQUIRED
              C
              C POL(1,N) - BOD-FIVE LOADING FOR CATEGORY FIVE
              C POL(2,N) - SUSPENDED SOLIDS LOADING FOR CATEGORY FIVE
              C POL(3,N) - BOD-FIVE LOADING FOR CATEGORY SIX
              C POL(4,N) - SUSPENDED SOLIDS LOADING FOR CATEGORY SIX
              C RP -  PER CENT BOD REMOVAL REQUIRED
              C K2 -  REAERATION CONSTANT
              C
              C LAND  - URBANIZED AREA NOT SERVED BY COMBINED SEWERS
              C POP   - POPULATION NOT SERVED BY COMBINED SEWERS
              C PDSS  - POPULATION DENSITY OF AREA NOT SERVED BY COMBINED SEWERS
              C POP1  - 1990 URBANIZED AREA POPULATION
              C SSPOP - 1990 POPULATION NOT SERVED BY COMBINED SEWERS
              C LAND1 - 1990 URBANIZED AREA NOT SERVED BY COMBINED SEWERS
              C LAND2 - GROWTH IN AREA BETWEEN 1970 AND 1990
              C
              C CM    - CURB MILES IN URBANIZED AREA
              C
              C SSI   -PER CENT IMPERVIOUSNESS FOR AREA NOT SERVED BY COMBINED SEWERS
              C DVSS  -DESIGN VOLUME FOR STORM SEWER AREA
              C NSSTP -NUMBER OF TREATMENT PLANTS FOR STORM SEWERED AREA
              C SPTP  -STORAGE PER TREATMENT PLANT
              C
              C RORI  -PER CENT RUNOFF FROM IMPERVIOUS AREA
              C IMAR  -TOTAL IMPERVIOUS AREA
              C SAW   -PER CENT IMPERVIOUSNESS DUE TO STREETS
              C PROS  -PER CENT RUNOFF DUE TO STREETS
              C PPRS  -PER CENT OF POLLUTANTS REMOVED BY STREET SWEEPING
              C SSGI  - PER CENT IMPERVIOUSNESS IN GROWTH AREA
              C PDG  - POPULATION DENSITY IN GROWTH AREA
              C ROCG - RUNOFF COEFFICIENT IN GROWTH AREA
              C
              C VOL   -VOLUME OF RUNOFF FROM GROWTH AREA
              C MONEY -COST OF BUILDING DETENTION BASINS TO TREAT RUNOFF FROM THE GROWTH
              C         AREA
              C
0001                COMMON     N,BETA(11,320),RAIN(2,320),STR(2,320),KLAS(3,320),DS(32
                   .0),POL(4,320),DVSS(320)
0002                COMMON /PRIN1/NG(3,320),ALPHA(5,320)
0003                READ(5,100)N
0004            100 FORMAT(I5)
0005                DO 50 J=1,N
0006                READ(5,101) (NG(I,J),I=1,3),(ALPHA(I,J),I=1,5),(BETA(I,J),I=1,6)
0007            101 FORMAT (I4,2I3,5A4,2F6.0,F6.1,F6.0,F10.0,F10.1)
0008             50 CONTINUE
0009                DO 60 J=1,N
0010                READ(5,106)(BETA(I,J),I=7,11),(RAIN(I,J),I=1,2),(STR(I,J),I=1,2),
                   .(KLAS(K,J),K=1,3)
0011            106 FORMAT(F11.0,F10.0,F5.0,F4.0,F9.4,F4.0,F6.2,F15.0,F3.0,I2,I4,I3)
0012             60 CONTINUE
0013                WRITE(6,400)
```

```
0014          400 FORMAT(1H1/60X,'BASE DATA'/40X,'EPA 1974 NEEDS SURVEY CATEGORIES 5
                 . & 6'//)
0015              WRITE (6,201)
0016              NOPT=0
0017              DO 700 J=1,N
0018              IF (40.GT.NOPT) GO TO 72
0019           71 WRITE (6,400)
0020              WRITE(6,201)
0021              NOPT=0
0022           72 WRITE(6,203)  (NU(I,J),I=1,3),(ALPHA(I,J),I=1,5),(BETA(I,J),I=1,9
                 .),BETA(11,J)
0023              NOPT=NOPT+1
0024          700 CONTINUE
0025              NOPT=0
0026              WRITE(6,400)
0027              WRITE(6,202)
0028              DO 800 J=1,N
0029              IF (40.GT.NOPT) GO TO 82
0030           81 WRITE(6,400)
0031              WRITE(6,202)
0032              NOPT=0
0033           82 WRITE(6,204)     (NU(I,J),I=1,3),(ALPHA(I,J),I=1,5),(RAIN(K,J),K=1,
                 .2),(STR(L,J),L=1,2),(KLAS(I,J),I=1,2)
0034              NOPT=NOPT+1
0035          800 CONTINUE
0036          202 FORMAT (1H /1X,'EPA STATE NO. URBANIZED AREA NAME     NO. STORMS
                 .     AVERAGE      STREAMFLOW       PER CENT UA      STREAM',14X,
                 . 'NO.'/1H ,1X,'NO.  NO.',30X,'PER YEAR      YEARLY RAIN',9X,'CFS',8
                 .X,'DRAINED STREAM   CLASSIFICATION'//)
0037          201 FORMAT (1H /1X,'EPA STATE NO. URBANIZED AREA NAME  STATE POPULATIO
                 .NS   COM SEWER OVERFLOW    URBANIZED AREA     SMSA POPULATIONS
                 .AVG D.A.  EPA'/1H ,' NO.  NO.',27X,'1990 OBERS 1990 EPA      AREA
                 .     POP.      POP.    AREA SORT   1970       1990    PER CSO   COST'
                 ./1H ,
                 . 89X,'1000 PERSONS   1000 ACRES 1000 PER',52X,'INDEX'/)
0038          204 FORMAT (1H ,I4,I6,I4,2X,5A4,F10.0,F16.2,F13.0,F16.0,12X,I2,16X,I3)
0039          203 FORMAT(1H ,I3,I6,I4,2X,5A4,2F10.0,2F10.1,F10.0,F10.1,2F10.0,F7.0,F
                 .9.4)
0040              WRITE (6,133)
0041          133 FORMAT (1H0,50X,'END'/1H1)
0042              CALL CATS
0043              STOP
0044              END
```

```
FORTRAN IV G LEVEL  21                CATS               DATE = 76306        17/01/54                PAGE 0001
 0001              SUBROUTINE CATS
 0002              COMMON     N,BETA(11,320),RAIN(2,320),STR(2,320),FLAR(3,320),DS(32
                  .0),PUL(8,320),DVSS(320)/PRIN1/MD(3,320)
 0003              COMMON/CSIX/LAND2(320),CM(320),             NSSTP(320),PPRS(320),MONE
                  .Y(320),TBSS(320),SPTP(320)
 0004              DIMENSION LAND1(320)
 0005              REAL   MRF,IMAP ,MONEY     ,MNS,LAND1,LAND2,LAND
            C
            C  THIS SUBROUTINE WILL CALCULATE THE PRELIMINARY VALUES USED TO COMPUTE
            C    THE CATEGORY SIX COSTS
            C
 0006              DO 50 I=1,N
 0007              STR(2,I)=STR(2,I)/100.
            C
            C THIS NEXT STEP CALCULATES THE POPULATION DENSITY IN THE AREAS WITHOUT
            C  COMBINED SEWERS
            C
 0008              LAND = BETA(8,I)*640.0-BETA(3,I)*1000.0
 0009              POP = BETA(5,I)-BETA(4,I)*1000.0
 0010              POSS = POP/LAND
 0011              IF (POSS.LT.1.56) POG=1.56
 0012              IF (POSS.GE.1.56) POG=POSS
            C
            C THE NEXT EQUATION CALCULATES THE CURB MILES IN EACH URBANIZED AREA
            C
 0013              CM(I)= LAND*(0.0782-0.0668*(0.839)**POSS)
            C
            C THE NEXT STEP CALCULATES THE PER CENT IMPERVIOUSNESS, THE RUNOFF
            C  COEFFICIENT,DESIGN STORM,THE REQUIRED STORAGE
            C
 0014              SSI= 9.6*POSS**(0.573-0.0391*ALOG10(POSS))
 0015              ROCS=0.75*(SSI/100.)+0.15
 0016              MNS=1.002**RAIN(1,I)-2.50
 0017              MRF=RAIN(2,I)/MNS
 0018              DS(I)=1.61*MRF
 0019              DVSS(I)=DS(I)*ROCS*LAND*.027150
 0020              NSSTP(I)=(LAND)/BETA(9,I)
 0021              NSSTP(I)=NSSTP(I)+1
 0022              SPTP(I)=DVSS(I)/NSSTP(I)
            C
            C  THE NEXT STEP CALCULATES THE PER CENT OF RUNOFF DUE TO STREETS AND THE
            C   PER CENT OF POLUTANTS REMOVED BY SWEEPING
            C
 0023              ROCI=0.90*SSI/(ROCS*100.)
 0024              IMAP=LAND*SSI/100.
 0025              SM   =CM(I)/2
 0026              SAR=(SM    *5280.*34./43560.)/IMAP
 0027              PROS=SAR*ROCI
 0028              PPRS(I)=(0.55*2*PROS)/(1+PROS)
            C
            C THE FOLLOWING EQUATIONS CALCULATE THE AMOUNT OF BOD-5 AND SUSPENDED
            C  SOLIDS DUE TO STORM WATER RUNOFF
            C
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```
0029            POL(3,I)=(0.420*US(I)+(0.142+0.218*PORS**0.54)+ 0.462*DS(I))*LAND*       55
               .2*STR(2,I)                                                                56
0030            POL(4,I)=(0.52*DS(I)+(0.142+0.218*PDSS**0.54)+25.94*DS(I))*LAND*2*       57
               .STR(2,I)                                                                  58
0031            TRSS(I)=SPIP(I)/(365/NNS)                                                 59
          C                                                                               60
          C THE FOLLOWING EQUATION  CALCULATES THE VOLUME OF RUNOFF FROM THE URBANIZED    61
          C GROWTH AREA AND COSTS ASSOCIATED WITH THIS VOLUME                             62
          C                                                                               63
0032            SSGI= 9.6*PDG**(0.573-0.0391*ALOG10(PDG))
0033            RUCG=0.75*(SSGI/100.)+0.15
0034            POP1    =BETA(5,I)*(BETA(8,I)/BETA(7,I))*(BETA(2,I)/BETA(1,I))            21
0035            SSPOP     =POP1-BETA(4,I)*1000.                                           22
0036            LAND1(I)=SSPOP/PDG
0037            LAND2(I)=LAND1(I)-LAND                                                    24
0038            IF (LAND2(I).LT.0.0) LAND2(I)=0.0
0039              VOL=RUCG*LAND2(I)*DS(I)*.027158*1000000.
0040            MONEY(I)=VOL*0.5                                                          65
0041         50 CONTINUE                                                                  66
0042            WRITE(6,856)  (LAND2(I),CM(I),DVSS(I),NSSTP(I),PPRS(I),MONEY(I),
               .TRSS(I),SPIP(I),NO(3,I),I=1,N)
0043        856 FORMAT(1H ,3F15.2,I10,4F15.2,5X,I5)
0044            WRITE (6,899)    (POL(3,I),POL(4,I),NO(3,I),I=1,N)
0045        899 FORMAT (1H ,2F15.2,10X,I5)
0046            CALL CATF                                                                 67
0047            RETURN                                                                    68
0048            END                                                                       69
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FORTRAN IV G LEVEL  21                CATF              DATE = 76364        17/01/54              PAGE 0001

                                                                                              70
 0001            SUBROUTINE CATF
 0002            COMMON     N,BETA(11,320),RAIN(2,320),STR(2,320),KLAS(3,320),DS(32
                .0),POL(4,320),UVAS(320)/PRIN1/NN(3,320)
 0003            COMMON/CFIV/TRCS(320),DVCS(320),STCS(320),NTP(320),RR(320),CTR(320        73
                .),NSP(320)
 0004            DIMENSION RNC(320)                                                            75
 0005            REAL    N2,MRF,MNS
           C
           C THIS SUBROUTINE COMPUTES THE INITIAL VALUES WHICH ARE USED IN COMPUTING         76
           C COSTS FOR CATEGORY FIVE
           C
           C          COSTS FOR CATEGGORY FIVE IN 1975 AND 1990 WILL BE IDENTICAL SINCE 77
           C IT IS ASSUMED NO NEW COMBINED SEWERS WILL BE BUILT.                              78
           C                                                                                 79
           C THE FOLLOWING SEQUENCE OF CALCULATIONS COMPUTE THE RUNOFF COEFFICIENT,           80
           C DESIGN STORM,NUMBER OF TREATMENT PLANTS,AND THE REQUIRED STORAGE AND            81
           C TREATMENT RATE                                                                  82
           C                                                                                 83
 0006            DO 30 I=1,N                                                                   84
 0007            RNC(I)=0.0
 0008            IF (BETA(3,I).EQ.0.0)  GO TO 913                                              85
 0009            PDCS=BETA(4,I)/BETA(3,I)
           C
           C   CALCULATES THE DESIGN STROM FOR EACH URBANIZED AREA
           C                                                                                 86
 0010            CSI =9.6*PDCS**(0.573-0.0391*ALOG10(PDCS))                                    87
 0011            RNC(I)=(0.15+0.75*(CSI/100.))                                                 88
 0012            MNS=1.0026*RAIN(1,I)-2.58                                                     89
 0013            MRF=RAIN(2,I)/MNS
 0014            DS(I)=2.30*MRF
           C
           C CALCULATES THE DESIGN VOLUME , NUMBER OF TREATMENT PLANTS, TREATMENT
           C RATE, AND STORAGE PER TREATMENT PLANT FOR EACH URBANIZED AREA.
           C                                                                                 91
 0015            DVCS(I)=DS(I)*RNC(I)*BETA(3,I)*27.158
 0016            NSP(I)=(BETA(3,I)*1000)/ BETA(9,I)                                            93
 0017            NSP(I)=NSP(I)+1                                                               94
 0018            STCS(I)=DVCS(I)/NSP(I)                                                        95
 0019            TRCS(I)=STCS(I)/(365/MNS)
 0020            NTP(I)=BETA(3,I)**0.435                                                       93
 0021            NTP(I)=NTP(I)+1
 0022            CTR(I)=DVCS(I)/(NTP(I)*365/MNS    )
           C
           C  CALCULATES THE POLUTIONAL LOADS FOR EACH URBANIZED AREA IN POUNDS PER DAY
           C                                                                                 96
 0023            POL(1,I)=1.73*DS(I)*(0.142+0.218*PDCS**0.54)+1.9*DS(I)                        97
 0024            POL(2,I)=39.2*DS(I)*(0.142+0.218*PDCS**0.54)+25.94*DS(I)                     106
 0025            POL(1,I)= (POL(1,I)*BETA(3,I)*2000.0*STR(2,I))                               107
 0026            POL(2,I)= (POL(2,I)*BETA(3,I)*2000.0*STR(2,I))
 0027            GO TO 30
 0028        913 DVCS(I)=0.0
 0029            NTP(I)=0.0
 0030            STCS(I)=0.0
```

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FORTRAN IV G LEVEL  21                CATF                DATE = 76364         17/01/58             PAGE 0002
0031                TRCS(I)=0.0
0032                POL(1,I)=0.0
0033                POL(2,I)=0.0
0034                DS(I)=0.0
0035                LSR(I)=0.0
0036                NSP(I)=0.0
0037             30 CONTINUE                                                                     148
              C
              C THE NEXT SEQUENCE OF CALCULATIONS COMPUTES THE PROPORTION OF STREAM FLOW
              C ATTRIBUTED TO EACH URBANIZED AREA, WHEN TWO OR MORE URBANIZED AREAS ARE
              C ADJACENT TO ONE ANOTHER, SHARE THE SAME RECEIVING STREAM, BUT ARE IN
              C DIFFERENT STATES
              C
0038                DO 60  J=1,38                                                                149
0039                POLT=0                                                                       150
0040                DO 70  I=1,N                                                                 151
0041                IF (KLAS(3,I).EQ.J) GO TO 61                                                 152
0042                GO TO 70                                                                     153
0043             61 POLT=POLT+POL(1,I)+POL(3,I)+0.0255*BETA(5,I)*STR(2,I)                        154
0044             70 CONTINUE                                                                     155
0045                DO 60  I=1,N                                                                 156
0046                IF (KLAS(3,I).EQ.J) GO TO 81                                                 157
0047                GO TO 60                                                                     158
0048             81 STR(1,I)=((POL(1,I)+POL(3,I)+0.0255*BETA(5,I)*STR(2,I))/POLT)*STR(           159
                   .1,I)                                                                         160
0049             60 CONTINUE                                                                     161
              C
              C NEXT STEP CALCULATES THE REMOVAL FACTOR USED IN COMPUTING REMOVAL REQUIRED        161
              C
0050                DO 35 I=1,N                                                                  162
              C
              C  ASSIGNS K2 VALUES TO APPROPRIATE STREAM CLASSIFICATIONS
              C
0051                IF(KLAS(1,I)-1) 2,3,4
0052              3 K2=0.75                                                                      99
0053                GO TO 2                                                                      100
0054              4 IF(KLAS(1,I)-2) 2,5,6                                                        101
0055              5 K2=1.75                                                                      102
0056                GO TO 2                                                                      103
0057              6 IF(KLAS(1,I)-3) 2,7,8                                                        104
0058              7 K2=0.75                                                                      105
0059                GO TO 2                                                                      106
0060              8 IF(KLAS(1,I)-4) 2,9,10                                                       107
0061              9 K2=0.32                                                                      108
0062                GO TO 2                                                                      109
0063             10 IF(KLAS(1,I)-5) 2,11,12                                                      110
0064             11 K2=0.18                                                                      111
0065                GO TO 2                                                                      112
0066             12 IF(KLAS(1,I)-6) 2,13,14                                                      113
0067             13 K2=0.08                                                                      114
0068                GO TO 2                                                                      115
0069             14 IF(KLAS(1,I)-7) 2,15,16                                                      116
0070             15 K2=0.15                                                                      117
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FORTRAN IV G LEVEL  21              CATF              DATE = 76364         17/01/54              PAGE 0003

 0071               GO TO 2                                                               118
 0072            16 IF(KLAS(1,I)-8) 2,17,18                                               119
 0073            17 K2=0.30                                                               120
 0074               GO TO 2                                                               121
 0075            18 IF(KLAS(1,I)-9) 2,19,20                                               122
 0076            19 K2=0.80                                                               123
 0077               GO TO 2                                                               124
 0078            20 IF(KLAS(1,I)-10)2,21,22                                               125
 0079            21 K2=0.50                                                               126
 0080               GO TO 2                                                               127
 0081            22 IF(KLAS(1,I)-11) 2,23,24                                              128
 0082            23 K2=0.40                                                               129
 0083               GO TO 2                                                               130
 0084            24 IF(KLAS(1,I)-12) 2,25,26                                              131
 0085            25 K2=0.15                                                               132
 0086               GO TO 2                                                               133
 0087            26 IF(KLAS(1,I)-13) 2,27,28                                              134
 0088            27 K2=0.06                                                               135
 0089               GO TO 2                                                               136
 0090            28 IF(KLAS(1,I)-14) 2,29,32                                              137
 0091            29 K2=0.12                                                               138
 0092               GO TO 2                                                               139
 0093            32 IF(KLAS(1,I)-15) 2,31,2                                               140
 0094            31 K2=0.59                                                               141
 0095             2 CONTINUE                                                              142
          C
          C THE NEXT STEPS COMPUTE THE REMOVAL REQUIRED FOR EACH URBANIZED AREA
          C
 0096               RF   = (POL(1,I)+POL(3,I)+0.0255*BETA(5,I)*STR(2,I))/((2.*STR(2,I)       163
                   .*(DVCS(I)+DVSS(I))+1.55*STR(1,I)+BETA(5,I)*STR(2,I)+0.00019)*K2)         164
 0097               IF (RF.LE.69.0) RR(I)=0.0                                             165
 0098               IF (RF.GT.69.0) GO TO 56                                              166
 0099               GO TO 57                                                              167
 0100            56 IF (RF.LT.225.0)RR(I)=(184.7*ALOG10(RF)-339.6)/100.                  168
 0101            57 IF (RF.GE.225.0) RR(I)=0.95                                           169
 0102            35 CONTINUE                                                              170
 0103               WRITE(6,688)(DS(I),NTP(I),CTR(I),NSP(I),TRCS(I),DVCS(I),STCS(I),RO
                   .C(I),RR(I),NO(3,I),I=1,N)
 0104           688 FORMAT (1H ,F10.2,I10,F10.2,I10,5F10.2,5X,I5)
 0105               WRITE (6,898)    (POL(1,I),POL(2,I) ,NO(3,I),I=1,N)
 0106           898 FORMAT (1H ,2F15.2,10X,I5)
 0107               CALL COST                                                             171
 0108               RETURN                                                                172
 0109               END                                                                   173
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FORTRAN IV G LEVEL  21                COST                 DATE = 76364         17/01/54                PAGE 0001

 0001              SUBROUTINE COST                                                                 175
 0002              COMMON     N,BETA(11,320),RAIN(2,320),STR(2,320),KLAS(3,320),DS(32
                  .0),POL(4,320),DVSS(320)
 0003              COMMON/CSIX/LAND2(320),CH(320),           NSSTP(320),PPRS(320),MONE           8
                  .Y(320),TWSS(320),SPTP(320)/PRIN1/NO(3,320)
 0004              COMMON/CFIV/TRCS(320),DVCS(320),STCS(320),NTP(320),RR(320),CTR(320            73
                  .),NSP(320)
 0005              COMMON/PRIN/LEVEL(2,320),COST1(2,320),COST2(2,320),COST3(320),NOPT
 0006              REAL   MONEY,LAND2
 0007              DO 400 NOPT=1,3                                                                 182
 0008              DO 400 I=1,N                                                                    183
 0009              IF (NOPT.EQ.2) GO TO 325                                                        184
 0010              IF (NOPT.EQ.3) GO TO 326                                                        185
 0011              LEVEL(1,I)=1                                                                    186
 0012              LEVEL(2,I)=1                                                                    187
 0013              GO TO 850                                                                       188
             C
             C THE NEXT SEQUENCE OF EQUATIONS WILL COMPUTE THE REQUIRED LEVEL OF                   189
             C TREATMENT                                                                           190
             C                                                                                     191
 0014          326 POL(1,I)= 1.70*POL(1,I)
 0015              POL(2,I)= 1.70*POL(2,I)
 0016              DVCS(I)= 1.70*DVCS(I)
 0017              TRCS(I)= 1.70*TRCS(I)
 0018              STCS(I)= 1.70*STCS(I)
 0019              CTR(I)= 1.70*CTR(I)
 0020          325 CONTINUE
 0021              PR1= (0.25*POL(1,I)+PPRS(I)*POL(3,I))/(POL(1,I)+POL(3,I))                      192
 0022              PR2=((0.75*POL(2,I)+(1-PPRS(I))*POL(4,I))/(2*(   DVCS(I)+DVSS(I))            193
                  .))*0.12                                                                        194
 0023              IF (PR1.LT.RW(I))GO TO 750                                                      195
 0024          650 IF (PR2.GT.400.) GO TO 750                                                      197
 0025              LEVEL(1,I)=1                                                                    198
 0026              LEVEL(2,I)=1                                                                    199
 0027              GO TO 850                                                                       200
 0028          750 PR1= (0.4*POL(1,I)+PPRS(I)*POL(3,I))/(POL(1,I)+POL(3,I))                       201
 0029              PR2=((0.5*POL(2,I)+(1-PPRS(I))*POL(4,I))/(2*(   DVCS(I)+DVSS(I))             202
                  .))*0.12                                                                        203
 0030              IF (PR1.LT.RW(I)) GO TO 851                                                     204
 0031              IF (PR2.GT.400.) GO TO 851                                                      205
 0032              LEVEL(1,I)=2
 0033              LEVEL(2,I)=1                                                                    207
 0034              GO TO 650                                                                       208
 0035          851 PR1=(0.6*POL(1,I)+PPRS(I)*POL(3,I) )/(POL(1,I)+POL(3,I))                       209
 0036              PR2=((0.3*POL(2,I)+(1-PPRS(I))*POL(4,I))/(2*(   DVCS(I)+DVSS(I))             210
                  .))*0.12                                                                        211
 0037              IF (PR1.LT.RW(I))GO TO 852                                                      212
 0038              IF (PR2.GT.400.)  GO TO 852                                                     213
 0039              LEVEL(1,I)=3                                                                    214
 0040              LEVEL(2,I)=1                                                                    215
 0041              GO TO 850                                                                       216
 0042          852 PR1= (0.8*POL(1,I)+PPRS(I)*POL(3,I))/(POL(1,I)+POL(3,I))                       217
 0043              PR2=((0.1*POL(2,I)+(1-PPRS(I))*POL(4,I))/(2*(   DVCS(I)+DVSS(I))             218
                    .))*0.12                                                              219
 0044                IF (PR1.LT.RR(I)) GO TO 853                                          220
 0045                IF (PR2.GT.400.)  GO TO 853                                          221
 0046                LEVEL(1,I)=4                                                         222
 0047                LEVEL(2,I)=1                                                         223
 0048                GO TO 850                                                            224
 0049            853 PR1= (0.4*POL(1,I)+.4*POL(3,I))/(POL(1,I)+POL(3,I))                  225
 0050                PR2=((0.3*POL(2,I)+.5*POL(4,I))/(2*(   DVCS(I)+DVSS(I)))))*.12       226
 0051                IF (PR1.LT.RR(I)) GO TO 854                                          227
 0052                IF (PR2.GT.400.) GO TO 854                                           228
 0053                LEVEL(1,I)=3                                                         229
 0054                LEVEL(2,I)=2                                                         230
 0055                GO TO 850                                                            231
 0056            854 PR1= (0.8*POL(1,I)+.4*POL(3,I))/(POL(1,I)+POL(3,I))                  232
 0057                PR2=((0.1*POL(2,I)+0.5*POL(4,I))/(2*(   DVCS(I)+DVSS(I)))))*.12      233
 0058                IF (PR1.LT.RR(I))GO TO 855                                           234
 0059                IF (PR2.GT.400.) GO TO 855                                           235
 0060                LEVEL(1,I)=4                                                         236
 0061                LEVEL(2,I)=2                                                         237
 0062                GO TO 850                                                            238
 0063            855 PR1= (0.8*POL(1,I)+0.6*POL(3,I))/(POL(1,I)+POL(3,I))                 239
 0064                PR2=((0.1*POL(2,I)+0.3*POL(3,I))/(2*(   DVCS(I)+DVSS(I)))))*.12      240
 0065                IF (PR1.LT.RR(I)) GO TO 856                                          241
 0066                IF (PR2.GT.400.) GO TO 856                                           242
 0067                LEVEL(1,I)=4                                                         243
 0068                LEVEL(2,I)=3                                                         244
 0069                GO TO 850                                                            245
 0070            856 PR1= (0.95*POL(1,I)+PPRS(I)*POL(3,I))/(POL(1,I)+POL(3,I))            246
 0071                PR2=((0.02*POL(2,I)+(1-PPRS(I))*POL(4,I))/(2*(DVCS(I)+   DVSS(I)))   247
                    .)*.12                                                                248
 0072                IF (PR1.LT.RR(I)) GO TO 857                                          249
 0073                IF (PR2.GT.400.)  GO TO 857                                          250
 0074                LEVEL(1,I)=5                                                         251
 0075                LEVEL(2,I)=1                                                         252
 0076                GO TO 850                                                            253
 0077            857 PR1= (0.95*POL(1,I)+0.40*POL(3,I))/(POL(1,I)+POL(3,I))               254
 0078                PR2=((0.02*POL(2,I)+0.50*POL(4,I))/(2*(DVCS(I)+   DVSS(I))))*.12     255
 0079                IF (PR1.LT.RR(I)) GO TO 858                                          256
 0080                IF (PR2.GT.400.0) GO TO 858                                          257
 0081                LEVEL(1,I)=5                                                         258
 0082                LEVEL(2,I)=2                                                         259
 0083                GO TO 850                                                            260
 0084            858 PR1=((0.95*POL(1,I)+0.6* POL(3,I))/(POL(1,I)+POL(3,I)))              261
 0085                PR2=((0.02*POL(2,I)+0.3*POL(4,I))/ (2*(DVSS(I)+   DVCS(I))))*.12     262
 0086                IF (PR1.LT.RR(I)) GO TO 859                                          264
 0087                IF (PR2.GT.400.0) GO TO 859                                          265
 0088                LEVEL(1,I)=5                                                         266
 0089                LEVEL(2,I)=3                                                         267
 0090                GO TO 850                                                            268
 0091            859 PR1=(0.95*POL(1,I)+0.8*POL(3,I))/(POL(1,I)+POL(3,I))                 269
 0092                PR2=((0.02*POL(2,I)+0.1*POL(4,I))/(2*(DVSS(I)+   DVCS(I))))*.12      270
 0093                IF(PR1.LT.RR(I)) GO TO 860                                           271
 0094                IF(PR2.GT,400.) GO TO 860                                            272
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0095                LEVEL(1,I)=5
0096                LEVEL(2,I)=4
0097                GO TO 850
0098            860 LEVEL(1,I)=5
0099                LEVEL(2,I)=5
              C
              C THE FOLLOWING SEQUENCE CALCULATES THE CAPITAL AND OPERATION AND MAINTENANCE
              C COSTS FOR EACH URBANIZED AREA
              C
              C THE NEXT SEQUENCE WILL CALCULATE THE COSTS FOR CATEGORY SIX  FOR VARIOUS
              C  LEVELS IN EACH URBANIZED AREA
              C
0100            850 IF (LEVEL(2,I).EQ.1) GO TO 970
0101                IF (LEVEL(2,I).EQ.2) GO TO 971
0102                IF (LEVEL(2,I).EQ.3) GO TO 972
0103                IF (LEVEL(2,I).EQ.4) GO TO 973
0104                IF (LEVEL(2,I).EQ.5) GO TO 973
0105            970 COST1(2,I)=CM(I)*80.08*11.251
0106                COST2(2,I)=CM(I)*283.92+(LAND2(I)*0.5*BETA(6,I)*640.)*16.
0107                GO TO 800
0108            971 COST1(2,I)=1.25*(150000*TRSS(I)**0.602 +43120*TRSS(I)**0.8173+2076
                   .55*TRSS(I)**0.503+25056*TRSS(I)**.698+3129*TRSS(I)**0.488+15200*(S
                   .PTP(I))**0.7168+177500*SPTP(I)**0.598)*NSSTP(I)+CM(I)*80.08*11.251
0109                COST2(2,I)=            (LAND2(I)*.5*BETA(6,I)*640.)*16.+     (200.*
                   .TRSS(I)**0.4627+13300+875.*TRSS(I)**.798+1000.*SPTP(I)**.47+1930*
                   .TRSS(I)**.468+2900*TRSS(I)**.7318+1790*TRSS(I)**.426+8828.5*TRSS(I
                   .)+75*TRSS(I)**.471+57*TRSS(I)**.838+880*SPTP(I)**.4+1229*TRSS(I)**
                   ..2067+92*TRSS(I)**.682+14*SPTP(I)**.51+6.8*TRSS(I)**.913)*NSSTP(I)
                   .+283.92*CM(I)
0110                GO TO 800
0111            972 COST1(2,I)= 1.25*(15200*SPTP(I)**0.7168+177500*SPTP(I)**0.598+1500
                   .00*TRSS(I)**0.602+5343*TRSS(I)**.720+48000*TRSS(I)**.611+147830*TR
                   .SS(I)**.83+207655*TRSS(I)**.503+25056*TRSS(I)**.698+3129*TRSS(I)**
                   .0.488)*NSSTP(I)+80.08*CM(I)*11.251
0112                COST2(2,I)=            (LAND2(I)*.5*BETA(6,I)*640.)*16.0+     (200*
                   .TRSS(I)**.4627+13300.+875.*TRSS(I)**.798+1000.*SPTP(I)**.47+1930.
                   .*TRSS(I)**.468+65.5*TRSS(I)**.8843+3465.*TRSS(I)**.332+2700*TRSS(I
                   .)**.618+1790.*TRSS(I)**.426+11102.5*TRSS(I)+75.*TRSS(I)**.471+57.*
                   .TRSS(I)**.838+880*SPTP(I)**.4+25.6*TRSS(I)**.698+36.*TRSS(I)**.662
                   .+1915.*TRSS(I)**.203+92.*TRSS(I)**.682+14.*SPTP(I)**.51+20*TRSS(I)
                   .**.86)*NSSTP(I)+283.92*CM(I)
0113                GO TO 800
0114            973 COST1(2,I)=    (15200*SPTP(I)**.7168+177500*SPTP(I)**.598+150000*TR
                   .SS(I)**0.503+46060*TRSS(I)**.611+5343*TRSS(I)**.720+19817*TRSS(I)*
                   .*.61165+43120*TRSS(I)**.8173+207655*TRSS(I)**.503+25056*TRSS(I)**0
                   ..698+3129*TRSS(I)**.48812)*NSSTP(I)*1.25+80.08*CM(I)*11.251
0115                COST2(2,I)=            (LAND2(I)*.5*BETA(6,I)*640.)*16. +     (200.
                   .*TRSS(I)**.4627+13300.+875*TRSS(I)**.798+1000*SPTP(I)**.47+1930.*
                   .TRSS(I)**.468+3465*TRSS(I)**.332+65.5*TRSS(I)**.8843+9166.5*TRSS(I
                   .)+2900*TRSS(I)**.7318+1790*TRSS(I)**.426+75*TRSS(I)**.471+57*TRSS(
                   .I)**.838+880*SPTP(I)**.4+36*TRSS(I)**.662+25.6*TRSS(I)**.698+100.*
                   .TRSS(I)**.626+1229*TRSS(I)**.2067+92*TRSS(I)**.682+14*SPTP(I)**.51
                   .+20*TRSS(I)**.86+6.8*TRSS(I)**.913)*NSSTP(I)+283.92*CM(I)
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```
 0116              IF(LEVEL(2,I).EQ.4) GO TO 800                                   322
 0117              COST1(2,I)= COST1(2,I)+ (104938*TPSS(I)**.7357)*NSSTP(I)*1.25   323
 0118              COST2(2,I)= COST2(2,I)+ (24*TPSS(I)+761*TPSS(I)**.256+3.8*TPSS(I)+  324
                  .22780)*NSSTP(I)                                                 325
             C                                                                     326
             C THE NEXT SEQUENCE WILL CALCULATE THE COSTS FOR CATEGORY FIVE FOR VARIOUS  327
             C  LEVELS IN EACH URBANIZED AREA                                      328
             C                                                                     329
 0119          800 IF(LEVEL(1,I).EQ.1) GO TO 820                                   330
 0120              IF(LEVEL(1,I).EQ.2) GO TO 821                                   331
 0121              IF(LEVEL(1,I).EQ.3) GO TO 822                                   332
 0122              IF(LEVEL(1,I).EQ.4) GO TO 823                                   333
 0123              IF(LEVEL(1,I).EQ.5) GO TO 823                                   334
 0124          820 COST1(1,I)=1.25*((90820.0*(2*STCS(I) )**0.602+13309*(2*STCS(I))**0
                  ..5975+106500*(0.15*STCS(I))**0.598+271500*(.15*STCS(I))**0.8027
                  .+150000*(.15*TRCS(I))**.823 )*NSP(I)+((5200*0.35*1.5625*BETA(3,I)
                  .)*(20*TRCS(I)**0.3))+(13110*(0.15*CTR(I))**0.955+3129*(0.15*CTR(
                  .I))**0.488)*NTP(I))
 0125              COST2(1,I)= (200*(0.15*CTR(I))**0.46270+75*(0.15*CTR(I))**0.471+
                  .10000+875*(0.15*CTR(I))**0.798+57*(0.15*CTR(I))**0.838+1530*(0.1
                  .5*CTR(I))**0.468+678*(.15*CTR(I))**0.201)*NTP(I)  +(875*(0.15*T
                  .RCS(I))**0.798+57*(0.15*TRCS(I))**0.838+6760+1930*(2*STCS(I))**0.
                  .468+200*(2*STCS(I))+2571*(2*STCS(I))**0.214  +1000*(0.15*STCS(I))
                  .**0.47+880*(0.15*STCS(I))**0.4+14*(0.15*STCS(I))**0.51+280*(0.15
                  .*TRCS(I))+1930*(0.15*TRCS(I))**0.468)*NSP(I)
 0126              GO TO 901
 0127          821 COST1(1,I)=1.25*((43120*CTR(I)**0.8173+247655*CTR(I)**0.503+50112*   346
                  .CTR(I)**0.698+3129*CTR(I)**0.488)*NTP(I)+ (5200*.35*1.5625*BETA(3,
                  .I))*(20*TRCS(I)**.3)+(106500*STCS(I)**0.598+271500*STCS(I)**0.8027
                  .+150000*STCS(I)**0.823 )*NSP(I))
 0128              COST2(1,I)= (200*CTR(I)**0.46276+75*CTR(I)**0.471+10000+875*CTR(I)
                  .**0.798+57*CTR(I)**0.838+1790*CTR(I)**0.426+92*CTR(I)**0.642+8587.
                  .5*CTR(I))*NTP(I)  +(1000*STCS(I)**0.47+880*STCS(I)**0.4+14*STCS(I)
                  .**0.51 +2500+1930*TRCS(I)**0.468+200*TRCS(I)+875*TRCS(I)**0.798+57
                  .*TRCS(I)**0.838)*NSP(I)+
                  .(2900*CTR(I)**0.7319+1229*CTR(I)**0.2067+6.8*CTR(I)**0.913)*NTP(I)
 0129              GO TO 901
 0130          822 COST1(1,I)= 1.25*((5343*CTR(I)**0.724+88000*CTR(I)**0.611+187830*C   355
                  .TR(I)**0.83+247655*CTR(I)**0.503+50112*CTR(I)**0.698+3129*CTR(I)**
                  .0.488)*NTP(I)+
                  .                                        (5200*0.35*1.5625*BETA(3,
                  .I))*(20*TRCS(I)**.3)+(106500*STCS(I)**0.598+271500*STCS(I)**0.8027
                  .+150000*STCS(I)**0.602 )*NSP(I))
 0131              COST2(1,I)= (200*CTR(I)**0.46276+75*CTR(I)**0.471+10800+875*CTR(I)
                  .**0.798+57*CTR(I)**0.838+1790*CTR(I)**0.426+92*CTR(I)**0.642+8587.
                  .5*CTR(I))*NTP(I)  +(1000*STCS(I)**0.47+880*STCS(I)**0.4+14*STCS(I)
                  .**0.51 +2500+1930*TRCS(I)**0.468+240*TRCS(I)+875*TRCS(I)**0.798+57
                  .*TRCS(I)**0.836)*NSP(I)+
                  .(85.5*CTR(I)**0.8803+25.6*CTR(I)**0.698+54*CTR(I)+3465*CTR(I)**0.3
                  .32+36*CTR(I)**0.662+20*CTR(I)**0.86)*NTP(I) +
                  .(2700*CTR(I)**0.618+1915*CTR(I)**0.203+2220*CTR(I))*NTP(I)
 0132              GO TO 901
 0133          823 COST1(1,I)= 1.25*((5343*CTR(I)**0.724+88000*CTR(I)**0.611+19817*CT   366
               .R(I)**0.01165+43120*CTR(I)**0.0173+247655*CTR(I)**0.503+50112*CTR(
               .I)**0.698+3129*CTR(I)**0.48412)*NTP(I)+
                                                        (5280*0.35*1.5625*BETA(3,
               .
               .I)))*(228*TRCS(I)**.3)+(10650*STCS(I)**0.596+271500*STCS(I)**0.0027
               .+150000*STCS(I)**0.607 )*NSP(I))
 0134           COST2(1,I)= (200*CTR(I)**0.46276+75*CTR(I)**0.471+10800*875*CTR(I)
               .**0.798+57*CTR(I)**0.830+1790*CTR(I)**0.426+92*CTR(I)**0.602+8587.
               .5*CTR(I))*NTP(I)  +(1000*STCS(I)**0.47+400*STCS(I)**0.4+14*STCS(I)
               .**0.51 +2500+1930*TRCS(I)**0.468+240*TRCS(I)+875*TRCS(I)**0.798+57
               .*TRCS(I)**0.838)*NSP(I)+
               .(2900*CTR(I)**0.7318+1229*CTR(I)**0.2067+6.8*CTR(I)**0.913)*NTP(I)
               .+(45.5*CTR(I)**.8843+25.6*CTR(I)**0.698+58*CTR(I)+3465*CTR(I)**0.3
               .32+36*CTR(I)**6.662+20*CTR(I)**0.86)*NTP(I) +
               .(284*CTR(I)+140*CTR(I)**0.624)*NTP(I)                                377
 0135           IF(LEVEL(1,I).EQ.4) GO TO 901                                         378
 0136           COST1(1,I)=COST1(1,I)+1.25*(10483*  CTR(I)**.7357)*NTP(I)             379
 0137           COST2(1,I)=COST2(1,I)+ ( 22760+27.8* CTR(I)+761* CTR(I)**.256)*NTP    380
               .(I)
 0138       901 CONTINUE
 0139           IF (NOPT.EQ.3) GO TO 670                                              581
 0140           GO TO 902
          C
          C THESE STEPS CALCULATE ADDITIONAL COSTS FOR RECREATIONAL CRITERIA
          C                                                                           583
 0141       670 IF(LEVEL(2,I).EQ.1) GO TO 671                                         584
 0142           COST1(2,I)=COST1(2,I)+   NSSTP(I)*(5343*TRSS(I)**.724+63039+5190*T    585
               .RSS(I) )*1.25                                                         586
 0143           COST2(2,I)=COST2(2,I)+        (85.5*TRSS(I)**.8843+1783*TRSS(I)**.5  587
               .97+25.6*TRSS(I)**.698+1134*TRSS(I)**.6954*TRSS(I))*NSSTP(I)
          C                                                                           588
          C THE NEXT EQUATIONS COMPUTE DISINFECTION COSTS FOR CATEGORY FIVE
          C                                                                           589
 0144       671 IF (LEVEL(1,I).GT.1) GO TO 672                                        590
 0145           COST1(1,I)=COST1(1,I)+1.25*NTP(I)*(5343*(2*STCS(I))**.724+63039+51    591
               .90*(2*STCS(I)))                                                       592
 0146           COST2(1,I)=COST2(1,I)+(85.5*(2*STCS(I))**.8843+1783*(STCS(I)*2)**.
               .597+25.6*(STCS(I)*2)**.698+1134*(STCS(I)*2)**.6954*STCS(I)*2)*NTP
               .(I)                                                                   594
 0147           GO TO 902                                                             595
 0148       672 COST1(1,I)= COST1(1,I)+(5343* CTR(I)**.724+63039+5190*CTR(I)  ) *1    596
               ..25*NTP(I)                                                            597
 0149           COST2(1,I)= COST2(1,I)+(85.5* CTR(I)**.8843+1783* CTR(I)**.597+25.    598
               .6* CTR(I)**.698+1134* CTR(I)**.6954* CTR(I))*NTP(I)                   599
          C                                                                           400
          C THE NEXT SEQUENCE OF EQUATIONS WILL CALCULATE THE CATEGORY SIX COSTS      401
          C  FOR THE GROWTH IN THE URBANIZED AREA BETWEEN 1970 AND 1990               402
          C
 0150       902 COST3(I) =((COST1(2,I)+ MONEY(I))*BETA(11,I))/1000000.
 0151           COST2(2,I)=((COST2(2,I)+ 0.07*(MONEY(I)))*BETA(11,I))/1000000.
 0152           COST2(1,I)  =(COST2(1,I)*BETA(11,I))/1000000.
 0153           COST1(2,I)  =(COST1(2,I)*BETA(11,I))/1000000.
 0154           COST1(1,I)  =(COST1(1,I)*BETA(11,I))/1000000.                         405
 0155       400 CONTINUE
 0156              WRITE (6,807)(NO(3,I),LEVEL(1,I),LEVEL(2,I),I=1,N)
 0157          807 FORMAT (1H ,I5,2I10)
 0158              CALL PRINT                                                        806
 0159              DO 827 I=1,N
 0160              COST1(1,I)=COST1(1,I)*1000000./BETA(11,I)
 0161              COST2(1,I)=COST2(1,I)*1000000./BETA(11,I)
 0162              COST1(2,I)=COST1(2,I)*1000000./BETA(11,I)
 0163              COST2(2,I)=  ((COST2(2,I)*1000000.)/BETA(11,I)  -0.02*MONEY(I)
 0164          827 CONTINUE
 0165          800 CONTINUE                                                          807
 0166              RETURN                                                            808
 0167              END                                                               809
```

```
      SUBROUTINE POUT
      COMMON/PRIN/LEVEL(2,320),COST1(2,320),COST2(2,320),COST3(320),NOPT
      DIMENSION ANAME(4,320), UBTOT(5), TOTAL(5)
      COMMON /PRIN1/NO(3,320),ALPHA(5,320)//N
      IF (NOPT.GT.1) GO TO 72
      READ (5,102)((ANAME(I,J),I=1,4),J=1,56)
  102 FORMAT (20A4)
   72 DO 71 K=1,5
      UBTOT(K)=0.00
   71 CONTINUE
      NUM=0
      N=0
      DO 123 J=1,56
      IF (J.EQ.1) GO TO 7
      IF (NUM.LT.15) GO TO 969
    7 IF (NOPT.EQ.1) GO TO 5
      IF (NOPT.EQ.2) GO TO 4
      WRITE(6,142)
  142 FORMAT (1H1//49X,  'NEEDS FOR URBAN STORMWATER CONTROL'/50X,'TO SA
     .TISFY THE RECREATION CRITERIA')
      GO TO 2
    5 WRITE (6,143)
  143 FORMAT (1H1//49X,'NEEDS FOR URBAN STORMWATER CONTROL'/49X,'TO SATI
     .SFY THE AESTHETICS CRITERIA')
      GO TO 2
    4 WRITE (6,144)
  144 FORMAT (1H1//49X,'NEEDS FOR URBAN STORMWATER CONTROL'/46X,'TO SATI
     .SFY THE FISH AND WILDLIFE CRITERIA')
    2 WRITE (6,145)
  145 FORMAT (1H0,3X,'EPA',7X,'URBANIZED AREA NAME',11X,'CATEGORY FIVE',
     .37X,'CATEGORY SIX'/1X,'REGION',30X,'PRESENT',11X,'O&M',23X,'PRESEN
     .T',10X,'1990',12X,'O&M'/38X,'CAPITAL COSTS    MIL $/YEAR' ,16X,'CA
     .PITAL COSTS   CAPITAL COSTS     MIL $/YEAR'/42X, 'MIL $',39X,'MIL
     .$',10X,'MIL $'//)
      NUM=0
  969 DO 11 K=1,5
      TOTAL(K)=0.00
   11 CONTINUE
      IF (J.LE.51) GO TO 9
      IF (J.GT.52) GO TO 77
   78 N=9
      GO TO 136
   77 IF (J.GT.54) GO TO 78
      N=7
      IF (J.EQ.53) GO TO 9
      GO TO 136
    9 DO 133 I=1,N
      IF (NO(2,I).EQ.J) GO TO 135
      GO TO 133
  135 WRITE(6,233)(ALPHA(K,I),K=1,5),COST1(1,I),COST2(1,I),COST1(2,I),
     .COST3(I),COST2(2,I)
      NUM=NUM+1
  233 FORMAT (1H0,  13X,5A4,        F12.3,F16.3,F27.3,2F16.3)
```

```
FORTRAN IV G LEVEL  21                 POUT               DATE = 76364        17.01.54              PAGE 0002

                   TOTAL(1)=TOTAL(1)+ COST1(1,I)
                   TOTAL(2)=TOTAL(2)+ COST2(1,I)
                   TOTAL(3)=TOTAL(3)+ COST1(2,I)
                   TOTAL(4)=TOTAL(4)+ COST3(I)
                   TOTAL(5)=TOTAL(5)+ COST2(2,I)
                   K=NO(1,I)
               133 CONTINUE
               136 CONTINUE
                   WRITE (6,138) K,  (ANAME(I,J),I=1,4),(TOTAL(L),L=1,5)
               138 FORMAT (1H0,I5,3X,4A4,'TOTAL',F16.3,F16.3,F27.3,2F16.3)
                   DO 123  K=1,5
                   USTOT(K)=USTOT(K)+TOTAL(K)
               123 CONTINUE
                   WRITE (6,111)(USTOT(L),L=1,5)
               111 FORMAT (1H0,6X,'TOTAL NATIONAL NEEDS',F19.3,F16.3,F27.3,2F16.3/1H1
                  .)
                   RETURN
                   END
```

APPENDIX D

COMMENTS ON THE DRAFT REPORT AND RESPONSES TO COMMENTS

Copies of the draft report of October, 1976 were sent to each State Water Pollution Control Director, State Needs Survey Director, Interstate Water Pollution Control Commission, and EPA regional office as well as numerous other individuals on October 22, 1976. Written comments on the draft report were requested by December 1, 1976.

A series of meetings was held in each EPA regional office November 8 through 23, 1976 to present the report and receive verbal comments. Written comments received prior to January 1, 1977 were incorporated in the final report.

Comment letters were received from 29 states, 1 territory, 3 interstate commisions, 3 cities, and 2 other organizations. Numerous other organizations were represented at the regional review meetings and offered verbal comments. The comment letters are reproduced on the following pages and the EPA responses follow each set of comments. The effort of those who read and commented on the draft report are appreciated. It is hoped that the responses will be as helpful as the comments.

STATE OF ALASKA
DEPT. OF ENVIRONMENTAL CONSERVATION

JAY S. HAMMOND, GOVERNOR

POUCH O – JUNEAU 99811

November 9, 1976

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
U. S. Environmental Protection Agency
401 M St. S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

This agency has reviewed the draft "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges", and we have the two following comments for your consideration:

1) Other than the introductory remark that the report is prepared to comply with the requirements of PL 92-500, there is no statement of purpose for the study. In what manner will the report be used and of what importance is it to the states? It is our understanding that construction grants funded under sec. 201 of PL 92-500 are not available for construction of storm sewers and separation of combined sewers.

2) The base data in Appendix B lists the EPA 1990 population forecast for Alaska as 408,000 (page B-8). This figure also appears elsewhere in EPA needs study data, and is far too low. Existing State Department of Labor statistics lists Alaska's present population as 406,000. A detailed reliable forecast of the State's population was recently prepared by the University of Alaska Institute of Social, Economic, and Government Research. The results of this study are summarized on the attached sheet. These forecasts take into account the phasing of various oil and gas projects. We recommend adoption of the 1990 forecast of 676,001 which assumes a pattern of limited development of oil and gas reserves.

Since this forecast has a bearing on our 201 grant allocations and presumably reflects future sewerage needs, we would like to take this opportunity to have it corrected.

Please call if you have questions regarding this review.

Sincerely,

for

Ernst W. Mueller
Commissioner

cc: Regional Administrator, Region X

EXHIBIT 18

ALASKA POPULATION PROJECTIONS

	1975*	1980**	1985**	1990**
Southeast	61,000	66,000	85,000	99,000
Southcentral	226,500	279,000	366,000	483,000
Southwestern	28,500	30,000	33,000	36,000
Interior	77,500	74,000	83,000	95,000
Northwestern	12,500	17,000	18,000	19,000
Statewide	406,000	466,000	585,000	722,000 ~~743,000~~

Errata Sheet correction

*Alaska Department of Labor

**Institute of Social, Economic, and Government Research, University of Alaska.

Alaska Outdoor Recreation Plan, 1976-1980

Dept. Natural Resources
Division of Parks

Table 4. Projected Population Changes for Alaska [1]
and the Southeast Region, 1975 to 1990.

YEAR	Limited Development [2]		Accelerated Development [3]	
	Southeast Alaska	All of Alaska	Southeast Alaska	All of Alaska
1975	51,527	376,601	51,527	376,601
1980	63,093	457,291	64,012	472,970
1985	75,448	571,434	83,706	647,707
1990	83,358	$\boxed{576,081}$	95,937	802,375

---

[1] Projections based on regional economic model developed for Man-in-the-Arctic Program by the Institute of Social, Economic and Government Research, University of Alaska, Anchorage, Alaska, 1976.

[2] Assumptions underlying limited development projections are that the Beaufort 1, Upper Cook Inlet/North Slope Uplands, Lower Cook Inlet, and Yukon-Klondike/Copper River oil developments will start by 1980. Also the North Slope Uplands 1 development will start by 1979; the Gulf of Alaska (East) by 1983 and the Gulf of Alaska (West) by 1984.

[3] Accelerated development assumes all the starts incl. under limited development scenario plus:

1981 - Lower Cook Inlet II
Gulf of Alaska (on or near shore)
1982 - West of Pet 4/NS Uplands
1983 - Beaufort II; West of Pet 4; Pet 4
1984 - Bering St. Geo/OBB
1985 - Beaufort/Chukchi

19 NOV 1976

Mr. Ernst Mueller, Commissioner
Department of Environmental
 Conservation
Pouch "O"
Juneau, AK 99811

Dear Mr. Mueller:

This is in reply to your letter of November 9, 1976, concerning the draft report "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges."

The Needs Survey is submitted to Congress in compliance with Sections 516(b)(2) and 205(a) of the Federal Water Pollution Control Act (PL 92-500). These provisions have the dual purpose of obtaining a comprehensive estimate of the total cost of meeting the goals of the FWPCA, and of estimating these costs State-by-State as a possible basis for the allocation of construction grant funds. As you may be aware, the Congress sets the allocation formulae, and in the past Category V has been partially included.

For data collection purposes, the 1976 Needs Survey was handled through two separate contracts. Categories V and VI were done using modeling techniques on a State-by-State basis, resulting in the draft report. Categories I through IV were done on a facility-by-facility basis, using data-of-record from the 1974 Survey as a starting point.

The 1976 Survey forms for Categories I-IV were updated by contractor personnel based in each Regional Office. These personnel had complete access to all Regional files, and also worked closely with each State Needs Director.

In a memo to all State and Regional Needs Survey Directors, dated March 25, 1976, we outlined the procedure to be used by the States to request a variance on the 1990 population projections. The stated April 15 deadline was later extended to April 30. We regret to inform you that since the data collection stage of the Survey is now completed and the 1990 population has been adjusted on a facility-by-facility basis, it is too late for us to grant a variance on Alaska's 1990 population ceiling.

I hope that this has answered your questions. If I can be of further help, please let me know.

Sincerely,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

Reproduced from best available copy.

STATE OF ALASKA
DEPT. OF ENVIRONMENTAL CONSERVATION

JAY S. HAMMOND, GOVERNOR

Pouch O
Juneau 99811

December 23, 1976

RECEIVED 27 Dec

Mr. James A. Chamblee, Chief
Needs Assessment Section (WH-547)
U.S. Environmental Protection Agency
401 M Street SW
Washington, D.C. 20460

Dear Mr. Chamblee:

Need Survey Estimates - Catagory V and VI

Thank you for your letter of December 16, 1976 which transmits a print-out of the final EPA estimates for Categories V and VI.

At this time we would like to submit for inclusion in your report to Congress, the State's estimate of needs for these two categories. Since the EPA needs are based upon an erroneous 1990 state population forecast of 408,000, as mentioned in our letter of November 9, 1976 to you, we have pro-rated the estimated needs to reflect a more realistic population forecast of 676,000. Accordingly, our estimate of needs for these categories is as follows:

Category V	$5.01 million
Category VI	$25.24 million

Thank you for your attention to this matter.

Sincerely,

JW Scribner

Jonathan W. Scribner
Director
Division of Water Programs

cc: EPA, Region X

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] JAN 1977

Mr. Johnathan W. Scribner
Director, Division of Water Programs
Department of Environmental Conservation
State of Alaska
Pouch O
Juneau, Alaska 99811

RE: Draft Report on 1976 Needs Survey for
Combined Sewer Overflows and Stormwater

Dear Mr. Scribner:

Thank you for your letter of December 23, 1976, which transmits your estimates of $5.01 million for Category V and $25.24 million for Category VI. We will include your estimates as well as the EPA estimates reported to you on December 16, 1976.

The final report, including all comments received from the States, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Coughlin, USEPA Region X
Needs Survey Coordinator

ARIZONA DEPARTMENT OF HEALTH SERVICES

Office of the Director

RAUL H. CASTRO, Governor
SUZANNE DANDOY, M.D., M.P.H., Director

NOV 30 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S.W.
Washington, D. C. 20460

Dear Mr. Chamblee:

RE: 1976 Needs Survey Categories V and VI

This is to notify you that this Department has received the draft report on needs for combined sewer overflows and storm sewers, categories V and VI respectively.

We have reviewed the methodology, needs estimates, and base input data and have no changes or comments to offer you at this time.

Sincerely,

Ted Williams
Deputy Director

TW:JAW:cma

cc: Bureau of Water Quality Control

State Health Building 1740 West Adams Street Phoenix, Arizona 850

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

16 JAN 1977

Mr. Ted Williams
Deputy Director
Arizona Department of Health Services
State Health Building
1740 West Adams St.
Phoenix, Arizona 85007

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Williams:

Thank you for your letter of November 30, 1976, on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

Sincerely yours,

J. A. Chamblee
James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Rock, Region IX

EDMUND G. BROWN JR., Governor

STATE OF CALIFORNIA—THE RESOURCES AGENCY

STATE WATER RESOURCES CONTROL BOARD

P. O. BOX 100 • SACRAMENTO 95801
(916) 445-7971

DEC 976

In Response Refer
to: 560:JA

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

"1976 SURVEY OF NEEDS FOR CONTROL OF POLLUTION FROM COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGES"

Requests for comments on the subject report, "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" were received by this Agency through various channels, including the Resources Agency, the State-Federal Water Programs Advisory Committee and the Environmental Protection Agency (EPA), Region IX. It is unfortunate that the opportunity to comment on the approach taken to assess needs in these areas was not offered at an earlier date. Much information, particularly in the area of combined sewer overflows, is available in California as a result of completed Step 1 and Step 2 work. Furthermore, the time that was allowed for review and comment was too short for a detailed review.

As part of the review process, a meeting with EPA was held on November 8. At that meeting, our staff expressed concern over the methodology used and the resulting reduction in needs. Money and time constraints were used to explain the lack of a more in-depth study on this complex subject. Far less effort has been expended to document Category V (combined sewer overflows) and Category VI (storm sewers) needs, than was used to develop needs for Categories I-IVB, though the former, in terms of cost, are greater than the latter. Comments have been solicited from the states; however, we are concerned that EPA may be locked into the methodology presented in the draft report. We do not believe that resulted in an accurate estimate of California's needs. The needs reported are much less than those documented by studies completed in California.

Enclosed are specific comments concerning the subject report. Also enclosed are comments that were solicited from San Francisco, which has the major portion of Category V needs in California.

I hope these observations will be used to assess the utility of the report. Mr. James Cornelius of our staff will be available to provide further comments on this report prior to final publication.

John Bryson

John E. Bryson
Chairman

Enclosures

cc: Environmental Protection Agency,
Region IX
ATTN: Mr. Robert Rock
100 California Street
San Francisco, CA 94111

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD
COMMENTS ON DRAFT REPORT

"1976 SURVEY OF NEEDS FOR CONTROL OF POLLUTION FROM COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGES"

Although it was requested that our review focus principally on the base data input, our greatest concern is in the methodology used to determine needs. As previously stated, we do not concur in the methodology used in the report. The results produced do not represent a reasonable assessment of national needs. The following comments were generated from the limited review of base data input and methodology (time constraints did not allow a review of the computer program):

Base Data

1. Streamflow data was not verifiable due to the lack of specific information given. The USGS gaging station or the particular reference used to determine streamflow should be identified.

2. The method used to determine the reaeration rate (k_2) is rather arbitrary and certainly is not validated by data obtained from the site studies.

3. Data from the 1967 APWA report used to obtain the average drainage area per combined sewer overflow is questionable and cannot be related to the drainage areas used from the 1975 APWA report.

Methodology

1. The derivations of numerous equations used in the mathematical model are questionable. Most equations were formulated from a limited data base. A particular example of this was acknowledged by the authors of the report as follows: "Unquestionably, the data base for estimating pollutant loads is very weak and the resulting estimating equations, supported by such a weak foundation should be used with extreme caution".

2. The receiving water quality criteria and the overall control levels are inconsistent with those addressed in NPDES/WDR permits, the "Water Quality Control Plan for Ocean Waters of California" and the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California". It is particularly disturbing to identify 1990 needs without considering control of such pollutants as heavy metals, pesticides, herbicides and asbestos.

3. The assimilative capacity of receiving waters was considered in the site studies; however, the resulting relationship to determine required level of treatment is very suspect when considering only the few data points used to develop it.

4. The proposed treatment schemes cannot be uniformly applied to all areas. The use of best management practices throughout the country is highly questionable. Removal of pollutants at the source by street sweeping is dependent on local economics, operations and pollutant loads. Utilization of existing facilities and optimization of treatment and storage can only be addressed for specific areas.

5. The cost estimating methodology used results in very low costs when compared to costs from completed Step 1 and Step 2 work. It would be more meaningful to document needs for Category V in the same manner as Categories I-IVB.

6. The site study attempted for San Francisco is another troublesome area. Although a receiving water impact evaluation could not be completed for San Francisco, the data derived from the other site studies was used to develop the model which ultimately did assess the impact and needs for San Francisco. The report stated that it was not intended to predict needs for a specific area and that it was a best estimate of statewide needs; however, the majority of California's Category V needs are in the San Francisco Bay Area. Attached are additional comments from the City and County of San Francisco.

7. Mathematical modeling has become increasingly useful in attempts to predict or assess environmental impacts. However, a mathematical model is useless if it cannot be validated. The draft report states that $334 million of EPA funds has been spent on combined sewer overflow control. It would be logical to assume that there is a wealth of information available to test the validity of the model.

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITARY ENGINEERING
770 GOLDEN GATE AVE. 3RD FL. SAN FRANCISCO, CAL. 94102 (415)558-2131

November 19, 1976

1976 EPH
Needs Survey:
Cat.'s V and VI

State Water Resources Control Board
P. O. Box 100
Sacramento, CA

Attention: Mr. Ed Dito

Gentlemen:

This letter is in response to the request of Mr. Dito of your staff and members of the EPA staff on the subject project to Mr. Cockburn of my staff for comments on the draft 1976 needs survey report for combined sewer overflow control and stormwater control (Categories V and VI respectively).

As Mr. Cockburn stated at the presentation meeting on November 8, 1976 in the EPA offices, we are greatly dismayed at the lack of coordination exhibited by the EPA in producing such a report without any contact with local or State agencies who have been intimately involved in the problem. Further, if it had not been for Mr. Dito's invitation, we would not have had any opportunity to comment on this report which might have severe impact upon the City's present program (as well as the State's). The time allowed to review and comment on the report was also much too short for any detailed review.

I am attaching a list of the City's general comments with specific examples where we have had time to develop them. Basically, the report estimates costs about ten times lower than our estimates for the same facilities. Also the basic methodology and control levels selected are subject to severe question. There appears to be little in the report to recommend it without major revision.

In light of the short time for review and the possible importance of such report in terms of funding, it is our request that the adoption and publication of this survey be delayed pending detailed review and revision.

We will be available to answer any questions which you might have concerning our comments and further to also aid and support your staff in conveying our comments to the EPA.

Very truly yours,

Friedland
H. O. Friedland, Chief
Bureau of Sanitary Engineering

Attach: As Noted

cc: EPA
Region IX Attn: Mr. Robert Rock

EPA
Municipal Construction Division
401 M St. S.W. WH 547
Washington D.C. 20460 Attn: Mr. Wen H. Huang

State of Ore.
Dept. of Environmental Quality
1234 S.W. Morrison St.
Portland, Oregon 97205 Attn: Mr. C. P. Hilbrick, Jr.

Comments on Draft 1976
Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges

1. The approach used of applying a uniform set of standards to all areas is not responsive to differing local needs and uses. It would be much better to allow each state to define its own needs. Each independant entity with a combined sewer overflow problem is probably much better informed as to its needs and costs. San Francisco is a good case in point. We have a program under construction with fairly definite goals for protection which are consistent with SWRCB and RWQCB goals as well as EPA approval for funding. Yet, the criteria used in the report are significantly different, with costs which are much lower than the City's program anticipates.

2. The method of developing storage volumes and treatment rates is not a method which we can relate to reality. The approach when applied to San Francisco results in a storage volume of 0.53 inches of rainfall and a treatment rate of about 70 MGD. This in turn would result in between 10 and 20 untreated overflows per year and a capture of less than one half of the rainfall runoff. Thus, the sizes put forth do not meet the 80 percent control criteria in the report even though they were developed following the methods used in the draft report.

3. The water quality criteria levels used and the overall control levels (80%) are inconsistant. For example, fish and wildlife protection must necessarily include shell fishing coliform standards for those waters where this beneficial use exists. This is not included in the criteria. To provide recreational protection will require better than 80% control. Otherwise,the receiving waters will not meet the stated criteria for a significant period of time. Control levels in the mid to high 90's are more appropriate. Further, toxicity removal may be the most significant benefit to category VI control yet it is totally ignored. All of these problems result from the attempt at uniform criteria rather than evaluating area by area needs.

4. No attempt was made to resolve the difference in costs between the 1973, 1974, NCWQ and 1976 estimates even though significant differences exist. This is an ommission which must be corrected.

5. The costs as stated in the report are low by factors of upwards of 10 times. For example the cost of San Francisco's present program is about 1,437 million dollars (ENR2800). Of this cost 962 million is for wet weather control. Yet the total State need is estimated at 159 million in the report. On

an areawide apportionment, San Francisco accounts for about one half of that value. Thus where we estimate a need of $962 million, the report estimates a need of about $80 million. This type of difference indicates that a detailed review of the cost bases is necessary.

A couple of examples of the inaccuracy of the estimating formulas will serve to point to one area of concern.

A. Pumping Station Costs:

EPA Formula
Cost = 98,826 (Peak Flow) expon. 0.602
For our Channel Street Station (P.F. = 100 MGD)
This results in a cost of $1.7 million.
The bid cost this year was $13.3 million for construction.

B. Cost of Pretreatment and Primary Sedimentation

EPA Formulas:
Screens: 43,120 (Treatment Rate) expon. 0.817,
Sedimentation: 13,110 (Treatment Rate) expon. 0.955
Using the Southeast Expansion as an example
(Peak Rate = 142 MGD)
Screens = $1.5 million
Sedimentation Tanks = $2.5 million
Sum = $4.0 million
City 10% design estimate = $40 million

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

Mr. John E. Bryson, Chairman
State Water Resources Control Board
Post Office Box 100
Sacramento, California 95801

Re: Draft Report on 1976 Needs Survey for
Combined Sewer Overflows and Stormwater

Dear Mr. Bryson:

Thank you for your letter of December 1, 1976 offering comments on our draft report which estimated needs for combined sewer overflow and stormwater control (Categories V & VI).

In response to your general comments, every attempt within budget and time constraints was made to obtain comments from the states on the draft report. An early draft report was published and distributed to the states prior to complete review within EPA. It is unfortunate, if the time constraints with this project allowed insufficient time for your detailed review and comment.

In regard to your specific comments on base data, the stream flow data was developed on an urbanized area basis and used USGS gaging information to determine the three month average low streamflow for each particular urbanized area. We agree that the method used to determine reaeration rates is rather arbitrary and we are requesting validation of this data by the states. Data from the 1967 APWA report was used only when more recent data was unavailable for a particular parameter. It is unfortunate that a complete up to date inventory of combined sewered area across the nation is not available.

In regard to your specific questions on methodology, the derivation of the equations used in the mathematical model were based on the available data base. This data base is very weak and the resulting estimated equations are difficult to verify and should be used only for general estimation purposes.

Definition of receiving water quality criteria for wet weather discharges is very difficult at the present time since state standards are non-existent for these stream flow conditions. Although the need for control of such pollutants as heavy metals, pesticides, herbicides, and asbestos have been identified, specific numerical state stream standards for these pollutants have not been documented.

The relationship developed to determine the required level of treatment utilized the available information developed during the project. Although it is unfortunate that more site studies could not be used to verify the relationship, it does point out that many areas do not require complete control of stormwater runoff to meet water quality standards. Additional data points have been added in the final report; the relationship between the assimilative capacity and required treatment level was not measurably affected.

We agree that the proposed treatment schemes cannot be uniformly applied to all areas. The schemes were identified to provide an increasing cost for increasing levels of control. Only by a detailed evaluation of specific local problems and feasible solutions can an applicable treatment scheme be defined for a specific area.

After a detailed review of the cost estimated equations used in the draft report, the equations were revised to predict more accurately present construction costs for these unit processes. These revisions in part have result in an approximate doubling of the project needs estimates for Categories V &VI. In regard to verification of the mathematical model, several approved facilities plans are being evaluated to assess the accuracy of the methodologies used in estimating needs for combined sewer overflow control. This is somewhat difficult to do because of differences in design parameters, facilities sizing, and other variables in methodology.

The final draft report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions. Enclosed is a copy of our response to Mr. A.O. Friedland's letter of November 19, 1976, a copy of which was included with your letter of December 1, 1976. If I can be of any further assistance, please let me know.

Sincerely yours,

J.A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

Enclosure

cc: Mr. Robert M. Rock, USEPA Region IX
Needs Survey Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

11 JAN 1977

Mr. A.O. Friedland, Chief
Bureau of Sanitary Engineering
Department of Public Works
City and County of San Francisco
770 Golden Gate Avenue, 3rd Floor
San Francisco, California 94102

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Friedland:

Thank you for your letter of November 19, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

After reviewing comments on the draft report, several changes have been made which significantly affect the needs estimates for Categories V and VI. The final needs estimate for the State of California is $385.115 million dollars, as compared with the draft report figure of $159 million.

In regard to your specific comments, the decision to apply a uniform set of wet weather standards and a uniform methodology to estimate state-by-state needs was developed based on the fact that nationwide information on a facility-by-facility basis is not available for either the combined sewer overflow problem or the stormwater problem.

The method for developing storage volumes and treatment rates was developed from existing literature and several simpliifying assumptions. The methodology was evaluated in detail in several cities and showed that the 80th percentile storm event would result in between 10 and 20 overflows per year and capture approximately 80 percent of the rainfall runoff. In the final report the control levels for combined sewer will be increased in response to comments which were received. The cost of achieving the aesthetics and the fish and wildlife criteria will be evaluated for control of the 90th percentile storm period. The cost of achieving the recreation criteria will be evaluated for an 98th percentile storm. For Category VI, all criteria will be evaluated for an 80th percentile storm. The final report will contain an expanded discussion of toxic pollutants.

Section 8.4 and 9.2 of the draft report discussed the differences in cost estimates between the 1973, 1974 and 1976 estimates. This section will be expanded to include comparison of the NCWQ cost estimates for the final report.

After a review of the cost equations in the draft report, several equations for unit processes were modified to represent more accurately the cost of actual construction. Significant adjustments were made to the pumping equation and to the storage equation. These changes, in addition to increasing the size of the design storm, provided the major reasons for the approximate doubling of the Category V cost estimate that was mentioned earlier.

Our Sanitary Engineer, Wen Huang, called Mr. R.T. Cockburn and requested the bid tabulations for the pumping station in question. As soon as we receive the material from you and complete the analysis, we will write to you further on this subject.

The final report, including all comments received, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Mr. John E. Bryson, Chairman
State Water Resources Control Board
Post Office Box 100
Sacramento, California 95801

Robert Rock, USEPA Region IX
Needs Survey Coordinator

JAN 1977

STATE OF CALIFORNIA—THE RESOURCES AGENCY
EDMUND G. BROWN JR., Governor

STATE WATER RESOURCES CONTROL BOARD
P. O. BOX 100 • SACRAMENTO 95801

In Reply Refer
to: 560:RB

JAN 5 – 1977

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

"1976 SURVEY OF NEEDS FOR CONTROL OF POLLUTION FROM COMBINED SEWER OVERFLOWS AND STORMWATER DISCHARGES"

The final EPA estimates for California's 1976 Needs Survey Categories V and VI, transmitted with your letter of December 16, 1976, were received with a certain amount of disappointment on our part.

The State of California and some of our local communities have spent a considerable amount of time and money studying various aspects of abating water pollution from combined sewer overflows and stormwater discharges.

In our December 1, 1976, letter to you, we commented on various inadequacies in the draft copy of the "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges". We also included a letter from the City of San Francisco which pointed out that San Francisco's wet weather control costs are currently estimated to be $962 million (based on an EPA funded Step 1 study). Yet your final estimate for California's Category V needs is only $385.115 million. Your final estimate for Category VI needs was $5,298.258 million which is considerably lower than our estimate of $9,761 million to $97,607 million.

It is our understanding that we are permitted to have an independent State estimate included in your report which is to be submitted to Congress on February 10, 1977.

California's estimate of needs in January 1976 dollars is:

Category V	$1,261 million
Category VI	$9,761 to $97,607 million

These estimates are based on a July 1974 report (enclosed) to the California State Water Resources Control Board which was done by Metcalf and Eddy, Incorporated. The range given for Category VI reflects the difference between a minimum comprehensive program and a fully developed program.

Due to the January 7, 1977, deadline for submittal of state estimates, I understand that the estimates listed were transmitted to your office on January 5, 1977, via telephone.

Mr. James Cornelius of our staff will be available to provide further comments, if necessary, prior to your submittal to Congress.

Bill B. Dendy

for John E. Bryson
Chairman

Enclosure

cc: Environmental Protection Agency,
Region IX
ATTN: Mr. Robert Rock
100 California Street
San Francisco, CA 94111

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

John E. Bryson, Chairman
State Water Resources Control Board
Post Office Box 100
Sacramento, California 95801

Your reference: 560:RB
Re: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Bryson:

Thank you for your letter of January 5, 1977 which transmits your estimate of $1,261 million for Category V and $97,607 million for Category VI. We will include the State estimate for Category V estimates as well as the EPA estimates reported to you on December 16, 1976.

We understand from recent conversations with your staff that the State estimate for Category VI should not be reported as an official independent State estimate. We will, however, discuss it in the text of our report to Congress.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section (WH-547)

cc: Robert Rock, USEPA, Region IX
Needs Survey Coordinator

COLORADO DEPARTMENT OF HEALTH

4210 E. 11TH AVENUE DENVER 80220 PHONE 388-6111

ANTHONY ROBBINS, M.D., M.P.A., EXECUTIVE DIRECTOR

November 23, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S. W.
Washington, D. C. 20460

Re: Needs for Catagories V and VI

Dear Jim:

Thank you for the opportunity to review and comment on the "Draft-1976 Survey of Needs for Control of Pollution From Combined Sewer Overflows and Stormwater Discharges". I am sorry to say that we do not have enough background data at this time to verify or disprove the findings in the report. The Area 208 agencies are developing required data, but until the plans are completed, we will not have sufficient information. Hopefully, sufficient information will be available for the next needs survey.

Sincerely yours,

FOR DIRECTOR, WATER QUALITY CONTROL DIVISION

Ronald G. Schuyler, P.E.
Technical Services and Grants Section

RGS/vg

cc: Hornberg, EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Ronald G. Schuyler, P.E.
Technical Services and Grants Section
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Schuyler:

Thank you for your letter of November 23, 1976 offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

As you state, the available data base developed through the 208 Agencies may provide a much more specific data base for the 1978 Needs Survey.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J A Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

CC: William Hormberg, USEPA Region VIII
Needs Survey Coordinator

FILE COPY

RECEIVED
4 Jan 77

COLORADO DEPARTMENT OF HEALTH

4210 EAST 11TH AVENUE · DENVER, COLORADO 80220 · PHONE 388-6111
Anthony Robbins, M.D., M.P.A. Executive Director

December 28, 1976

Mr. James A. Chamblee, Chief
Needs Assessment Section
U. S. Environmental Protection Agency
Washington, D. C. 20460

Re: Cost Estimates for Catagories V & VI, 1976
Needs Survey

Dear Mr. Chamblee:

We have received the computer printout of cost estimates for Catagories V and VI in Colorado. As we have no additional data with which to make independent estimates in these catagories, we feel that the EPA numbers are adequate.

Our office is now also in the process of reviewing your computer printouts for Catagories I-IVB. We have found numerous errors and omissions. In several cases, neither Dames & Moore's nor our numbers were used. Instead, the unrevised 1974 figures are shown! It will take several more days to complete our review of this portion of the needs survey. You can be assured, however, that our extensive comments will be submitted prior to January 10, 1977.

Very truly yours,

FOR DIRECTOR, WATER QUALITY CONTROL DIVISION

Ronald G. Schuyler

Ronald G. Schuyler, P.E. Chief
Technical Services & Grants Section

RGS/vg

cc: William H. Hornberg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

28 JAN 1977

Ronald G. Schuyler, P.E., Chief
Technical Services and Grants Section
Colorado Department of Health
4210 East 11th Avenue
Denver, Colorado 80220

Re: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Schuyler:

Thank you for your letter of December 28, 1976, in which you concur with the EPA Category V and VI cost estimates for the State of Colorado.

We have received your review of the print-out for Categories I-IVB and have made the required corrections. We certainly appreciate your efforts to make this an accurate survey.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section (WH-547)

cc: William Hornberg, USEPA, Region VIII
Needs Survey Coordinator

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

11 JAN 19

January 5, 1977

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. St. S.W.
Washington, D. C. 20460

Dear Mr. Chamblee:

Reference is made to your letter of December 16, 1976 transmitting revised cost estimates for Categories V and VI of the 1976 Needs Survey.

I would like to comment first on the cost estimates for Category VI (stormwater discharge control). You have provided estimates of $899,606,000 for needs existing in 1976 and $1,480,345,000 for needs expected thru 1990. These estimates compare favorably with the total state estimate of $2,667,000,000 submitted for the 1974 Need Survey.

Our 1974 needs estimate in Category VI was based on EPA guidance and we claim no independent analysis of cost on which to base projected cost. Therefore, we have no reason to question your estimates at this time. Further since we sense no intention on the part of EPA to request grant funding in this category nor any inclination on the part of the Congress to appropriate monies for this need, the estimates are probably best considered academic.

Although we acknowledge that we have made no concerted effort to make precise estimates of need in Category VI intuitively we feel that the expenditure of sums in the amounts projected cannot be justified on the basis of real water quality improvement. We feel that the voting local public would never support the local expenditure of 25% of the total cost or nearly $570,000,000 nor would they support federal expenditures of about three times that total if they had a real mechanism to separate their contributions toward that and from other federal taxes. Our admittedly intuitive attitude in this regard is not wholly arbitrary as we feel we can achieve the 1983 standards prescribed by the Congress without major expenditure in this category based on our monitoring of chemical and especially biological indicators of water quality.

In contrast to our rather ambivalent attitude with respect to the Category VI estimates, we take extreme exception to the estimates of expenditure need in Category V. We feel that the EPA estimate of $387,317,000 for Connecticut is totally unrealistic. As you know that figure contrasts with our estimate of more than $700,000,000 reported in the 1974 Needs Survey which is also, in our opinion, a low figure since we were not allowed, in the 1974 survey, to report expenditure estimates not derived from engineering reports on file. We had intende to submit more precise data than that used by your consultants to compute your estimates but determined that by doing so we would provide a basis for further reducing your estimates of cost making them even more unrealistic. One of the stated objectives emphasized by your consultants was to provide a uniform estimate to make the relative needs projections in the category a more valid basis of comparison among the states. It was our conclusion that more detailed base data would make your estimate of Connecticut needs in Category V less valid as a basis of comparison among the states.

We should reiterate our comments offered previously that we find little cause for accepting the relativity of estimates in any one category as a basis for accepting the methods used in the survey. Since the needs in Category V are the predominate needs in Connecticut, the cost estimates associated with those needs must be related to all categories of need used by the Congress to calculate dollar allocations especially since the fast approaching date of September 1977 is causing more and more states to divert expenditure to a category of need (Category IV B - collector sewers) which will not reduce and will probably increase their percentage of future allocation. Connecticut has chosen not to divert presently available monies from priority needs to support collector sewers in part because we feel it will force potential applicants to defer needed collector sewer construction normally financed by local appropriation to pursue federal grants not supported by the allocation of Congressional appropriation.

To further emphasize our comments offered previously, it would seem appropriate to again enumerate our major criticism of the 1976 Needs Survey for Category V. It appears that EPA has instructed the consultants to adopt criteria which assumes a degree of control which (1) WILL NOT ACHIEVE THE 1983 GOAL established in the Act by the Congress (2) WILL NOT ACHIEVE COMPLIANCE WITH STATE WATER QUALITY STANDARDS administratively imposed by the EPA, and (3) WILL PRECLUDE THE RESTORATION OF SHELLFISH AREAS FOR FOOD SUPPLY even if improved disinfection technology is developed to assure virus inactivation.

The above conclusions must be drawn from analysis of the criteria since they dictate a level of control that will allow undisinfected raw sewage to discharge without treatment.

In addition, we find it almost incomprehensible that combined sewer separation was not even considered an alternative control option. In our experience, combined sewer separation is the most cost effective control alternative for a majority of Connecticut communities with combined sewers. This is especially true in relativel small communities with only a portion of the system being combined in the older urban core. Often these systems were built in the 1800's and are so deteriorated physically that they are not economically salvagable or repairable for continued use. It is not uncommon to find that the pipe inverts have been completely abraded away. In our larger cities, where full separation may not be economically practical considerable separation will still, in our opinion, be necessary to insure that separate sewage from satellite communities can be conveyed through the combined system to treatment.

We also feel that the choice to assume overflows will only occur to the main stem of a river system draining an urban area is not valid and that the assumption may have caused an unrealistic reduction in computed needs. We are further concerned that reduced efficiency of treatment plant receiving combined sewage is being ignored.

Our conclusions are (1) that the 1976 Category V Needs Survey is a completely invalid basis for advising the Congress of the cost of achieving the goals of the Act, (2) that if the criteria on which the survey is based reflects EPA policy, the goals of the Act will not be achieved, and (3) that computing needs in a way that does not reflect achieving the goals of the Act or the cost of achieving those goals invalidates the concept of using needs as a basis for allocation. It would be tragic to ask the public to expend such vast sums of money as are projected for combined sewer overflow control and not achieve the goals they have been advised will be achieved; and even more tragic if those goals were virtually precluded from being achieved by the design of the control options imposed.

Very truly yours,

Robert B. Tayl

Robert B. Taylor
Director of Water Compliance
and Hazardous Substances

RBT/am

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] 1977

Mr. Robert B. Taylor
Director of Water Compliance and Hazardous Substances
Connecticut Department of Environmental Protection
State Office Building
Hartford, Connecticut 06115

RE: Draft Report on 1976 Needs Survey for Combined Sewer Overflows and Stormwater

Dear Mr. Taylor:

Thank you for your letter of January 5, 1977, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your comment regarding the wet weather water quality criteria utilized, it is our feeling that the control levels selected will enable the maintenance of the fishable, swimmable receiving waters a great majority of the time and are based on the most recent thinking in the field on what reasonable standards should be. Additionally, the control levels provide a cost effective approach to dealing with combined sewer overflows. Unfortunately, the time and budget constraints placed on the project precluded consideration in detail of what could be cost effective in view of specific local conditions and local standards for individual communities in Connecticut. We hope to be able to incorporate such information in the 1978 Needs Survey.

Sewer separation was not considered as a final alternative control option because it has been shown in most cases across the nation not to be cost effective. This does not preclude the use of separation where it is shown cost effective, but its general use in the 1976 Needs Survey would have resulted in an overestimate of the cost of controlling pollution from combined sewer overflows.

There was no assumption that overflows would only occur to the main stem of a river system. However, the receiving water quality impact analysis was only conducted on the main stem. We feel this assumption is valid, because in the majority of cases, the overflow volumes are quickly flushed from tributary streams due to high velocities and the major impact of the pollutants is on the larger river systems.

The final report, including all comments received from the states, will be forwarded to you in early February.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Charles Pease, US EPA Region I
Needs Survey Coordinator

Mr Rhett

Mr Whittington

STATE OF DELAWARE
DIVISION OF ENVIRONMENTAL CONTROL
EDWARD TATNALL BUILDING
DOVER, DELAWARE 19901

December 13, 1976

DEC 30 1976

Mr. John T. Rhett
Deputy Assistant Administrator
Water Programs Operation
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Rhett:

We are writing to you in response to the letter and draft report of October 22, 1976, on needs to control pollution from combined sewer overflows and separate storm sewers.

We think the work performed is a commendable and necessary effort. We find it to be a very thorough effort incorporating all the numerous variables bearing on the problem, and the task has been approached, in our opinion, in a very objective manner.

We have reviewed the base input data in Appendix B used in the needs estimation model as it relates to Delaware and have no serious issue to take with the data developed.

Again, we commend you on a very thorough effort on a complex subject.

Sincerely yours,

John C. Bryson

John C. Bryson
Secretary

JCB:RFA:jp

cc: Mr. John T. Egan
Mr. Robert J. Touhey
Mr. Richard F. Aurich

DEPARTMENT OF
NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
JOHN C. BRYSON
SECRETARY

The First State
DELAWARE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

[illegible] 1977

Mr. John Bryson
Secretary
Delaware Department of Natural Resources
and Environmental Control
Edward Tatnall Building
Dover, Delaware 19901

RE: Draft Report on 1976 Needs
Survey for Cobmined Sewer
Overflows and Stormwater

Dear Mr. Bryson:

Thank you for your letter of December 13, 1976, on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V and VI).

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

Sincerely yours,

J. A. Chamblee
James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

2562 EXECUTIVE CENTER CIRCLE, EAST
MONTGOMERY BUILDING
TALLAHASSEE, FLORIDA 32301

REUBIN O'D. ASKEW
GOVERNOR

JOSEPH W. LANDERS, JR.
SECRETARY

November 24, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S. W.
Washington, D. C. 20460

Dear Mr. Chamblee:

Re: Draft Report on Category V
and VI - 1976 Needs Survey

This Department has reviewed the draft report on category V and VI - 1976 Needs Survey. The criteria for the delineation of urbanized areas fails to take into consideration those areas which have a high tourist or transient influx. For example, there are several towns within driving distance of Disney World which, though below the 50,000 permanent population cut-off, have well over that number when tourists are considered. Most travel is by auto and the consequent increase in air and road contamination and impervious surfaces (additional parking lots, motels, restaurants, et cetera) have a significant impact on both the amount of run-off and consequent storm water pollution. This in turn will directly affect any planning, size of construction and the resultant costs of stormwater pollution abatement facilities. It is therefore recommended that high impact areas, be given special consideration for inclusion on your list of urbanized areas and in your NEMUR methodology, and further that the contractor be directed to contact each individual state to determine if and where such areas do exist. These areas may become an integral part of each category within the report or may be included as a special section. In either instance this procedure would more accurately reflect actual category VI needs.

The Department thanks you for the opportunity to review and comment on the draft report and would be interested in your evaluation and decision on this comment.

Sincerely,

Robert W. McVety for

Howard L. Rhodes, P.E., Chief
Bureau of Wastewater Management
and Grants

HLR/gwm

Cc: Mr. Jim Kutzman, EPA IV Needs Survey Director

BC&E

BLACK, CROW & EIDSNESS, INC.

CONSULTING ENGINEERS

PRINCIPAL OFFICE: 7201 N. W. ELEVENTH PLACE, GAINESVILLE, FLORIDA
REGIONAL OFFICES: ATLANTA, GEORGIA / CLEARWATER, FLORIDA
BIRMINGHAM, ALABAMA / BOCA RATON, FLORIDA / NAPLES, FLORIDA
SAN JOSE, COSTA RICA / PHILADELPHIA, PENNSYLVANIA / MONTGOMERY, ALABAMA

PLEASE REPLY TO:
GAINESVILLE, FLORIDA 32602
POST OFFICE BOX 1647
7201 N. W. ELEVENTH PLACE
904/377-2442
CABLE ADDRESS: BCEGNVFLA

November 29, 1976

Mr. Gordon R. Woodley
Environmental Specialist
State of Florida
Dept. of Environmental Regulation
2562 Executive Center Circle, East
Tallahassee, Florida 32301

Re: 1976 Survey of Needs for
Control of Pollution from
Combined Sewer Overflow
and Stormwater Discharge
Project No. 573-7600-4

Dear Mr. Woodley:

On Monday, November 15, 1976, you attended a meeting at EPA Regional Offices in Atlanta concerning review of the draft Categories V and VI, 1976 Needs Survey. At that time you expressed an interest in receiving a copy of the notes prepared for the site study portion of our presentation. Enclosed for your information is one copy of the above notes.

If you have any further questions, or need additional information regarding the site studies or design storm criteria, please let me know.

Very truly yours,

BLACK, CROW AND EIDSNESS, INC.

Ronald L. Wycoff

Ronald L. Wycoff, P.E.

RLW/mfl

Enclosure

xc: Mr. R. D. G. Pyne
Mr. Philip Graham

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Howard L. Rhodes, Chief, P.E.
Bureau of Wastewater Management and Grants
Florida Department of Environmental Regulation
2562 Executive Circle, East-Montgomery Building
Tallahassee, Florida 32301

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Rhodes:

Thank you for your letter of November 24, 1976, offering comments on our draft report which estimated needs for combined overflows and stormwater control (Categories V & VI).

Your specific comment requesting inclusion of non-urbanized areas for stormwater control needs was voiced by several states, although not all were interested in transient influxes of population. Regulations for the application of the NPDES Program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

The regulations defined the term separate storm sewer as "a conveyance or system of conveyances....located in an urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff." The NPDES permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Jim Kutzman, USEPA Region IV
Needs Survey Coordinator

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O.Box 3378
HONOLULU, HAWAII 96801

GEORGE A. L. YUEN
DIRECTOR OF HEALTH
Audrey W. Mertz, M.D., M.P.H.
Deputy Director of Health
James S. Kumagai, Ph.D., P.E.
Deputy Director of Health
Henry N. Thompson, M.A.
Deputy Director of Health

In reply, please refer to:
File: ________

November 24, 1976

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, SW
Washington, D.C. 20460

Dear Mr. Chamblee:

Subject: 1976 Needs Survey for
Categories V & VI Draft Report

Thank you for the opportunity to review the subject document. The following comments are offered for your consideration:

1. We recognize that due to the lack of data many assumptions were required to develop the cost estimates for Category VI needs. However, it is our opinion that the exclusion of the hydro-geological uniqueness of the islands of Hawaii in developing needs in terms of time of concentration of storm runoff, slope and distance to receiving waters, and the existence of numerous, small watershed basins as well as the high cost of land represents an inequitable means of comparing needs with other states.

2. The EPA cost index of 1.0578 which was utilized in determining cost of constructing facilities in Hawaii should be changed to 1.7. Justification for cost index of 1.7 was reviewed and approved by EPA in April, 1976. The said cost index was used in determining needs for Categories I through IV in the current 1976 Needs Survey.

3. According to the draft report, due to the lack of information, storage volume and treatment rates of storm sewer discharges are based on treating runoff from the average combined sewer overflow drainage area at each treatment plant. Since Hawaii has no existing combined sewers, it is apparent that Hawaii did not receive any credit for cost of constructing treatment or detention facilities. If the foregoing is correct, then the methodology used is obviously a great disadvantage on priority to states that have little or no combined sewers.

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The above comments are what we consider major factors which should be seriously considered in determining needs for Categories V and VI.

Sincerely,

JAMES S. KUMAGAI, Ph.D.
Deputy Director for
Environmental Health

DT/k:mt

This Is Recycled Paper

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 [illegible] 1977

Dr. James S. Kumagai
Deputy Director for Environmental Health
Hawaii Department of Health
Post Office Box 3378
Honolulu, Hawaii 96801

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Dr. Kumagai:

Thank you for your letter of November 24, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The average drainage area for a storm sewer treatment plant in the State of Hawaii was estimated at 239 acres per stormwater discharge location. As your letter so applicably put, the small drainage basins make construction of stormwater facilities difficult and expensive. This factor has been taken into account in the draft report due to the relatively small drainage area per stormwater discharge used for the State of Hawaii. The high land costs in Hawaii are not considered in our methodology as land cost is ineligible for the purposes of the municipal facilities grants program of EPA.

The cost index of 1.7 will be utilized to determine the cost of constructing facilities in Hawaii based on your April 1976 justification.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Rock, USEPA RegionIX
Needs Survey Coordinator

STATE OF IDAHO

DEPARTMENT OF HEALTH AND WELFARE

Division of Environment
Statehouse Mail
Boise, Idaho 83720

November 9, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facilities Requirements Branch (WH-547)
401 M Street S.W.
Washington, D. C. 20460

Dear Mr. Chamblee,

We have reviewed the draft report of the "1976 Survey of Needs" for control of pollution from combined sewer overflows, Category V, and stormwater discharges, Category VI.

The report is heavily biased in favor of those states with large urban populations and it does not adequately address problems inherent to states with smaller populations and more diverse demographic and geological variability. If the intent of this needs survey for Categories V and VI is for broad estimating purposes only, we would suggest that extreme caution be utilized in the application to individual states. A needs evaluation similar to that conducted in the 1976 needs assessment for Categories I through IV would better reflect the individual state needs for Categories V and VI.

The 1974 Idaho needs assessment for Categories V and VI show $36 million and $469 million respectively. The 1976 draft assessment for Idaho shows no current or 1990 needs in Category V and only $841 thousand in current and $8.86 million in needs for 1990 in Category VI. A recently completed water management study completed for Boise, Idaho, shows that the current urban stormwater treatment cost needs alone, depending on the level of treatment, vary from $995 thousand for simple treatment and sedimentation to as high as $33 million for complex treatment. The lowest cost in Category VI for a single Idaho urban area exceeds the total 1976 needs reported for the entire state.

Combined sewer overflows have been identified in many of our northern Idaho communities and are presenting problems in treatment and receiving water quality. The 36 million dollar 1974 needs estimate for Category V would not be realistic in light of current problems with combined sewer overflows.

If the Congressional Committee should include Categories V and VI needs in the construction grants allocation formula for the individual

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states, it is evident that states such as Idaho would be seriously penalized.

The needs estimation model for urban runoff (NEMUR) methodology may be satisfactory for broad estimating on a nationwide basis. The use of this model in states with a small population, such as Idaho, should be done with caution since many inherent problems characteristic of non-urban areas can be identified.

We appreciate the opportunity to comment on the draft and trust our comments will be taken into consideration.

Sincerely,

Orlando M. Dalke, Coordinator
Municipal Programs

OMD/tlb
cc: Bob Coughlin, MS 329

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Orlando M. Dalke, Coordinator
Municipal Programs
Idaho Department of Health & Welfare
Division of Environment
Statehouse Mail
Boise, Idaho 83720

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Dalke:

Thank you for your letter of November 9, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The report utilized to define the areas of each state served by combined sewer overflows (APWA-University of Florida, Report of EPA Research and Development Group) did not identify any combined sewered area in the State of Idaho. However, based on Mr. Philip Graham's telephone conversation with Mr. Michael McMasters on December 29, 1976, a combined sewer area for non-urbanized area of 1315 acres and associated population of 31,248 persons will be used for Category V of this 1976 Needs Survey.

Your comments relating to problems characteristic of non-urbanized areas were voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

In the regulations, the term "separate storm sewer" is defined as "A conveyance or system of conveyances....located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

The needs estimation model for urban runoff (NEMUR) was developed to provide relative estimates of state-by-state needs on a consistent basis. The model was not intended and should not be used to define site-by-site estimates for combined sewer or stormwater control. Only through a detailed engineering evaluation can these specific cost estimates be developed.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Coughlin, USEPA Region X
Needs Survey Coordinator

STATE OF IDAHO

DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT
Statehouse
Boise, Idaho 83720

December 29, 1976

Mr. Phillip Graham
Needs Assessment Section
Facilities Requirements Branch (WH-547)
401 M Street S.W.
Washington, D. C.

Dear Mr. Graham,

The following list of communities constitutes the identified Idaho needs for Category V (Combined Sewer Overflow Correction) that were transmitted as per our telephone conversation of December 29, 1976.

City	1976 Population	Acres Involved
St. Anthony	2877	116
Grace	827	78
New Plymouth	986	34
Rupert	4563	127
Wallace	6250	160
Sandpoint	4144	165
Orofino	3883	240
Grangeville	3636	267
Bovill	343	25
Troy	541	32
Spirit Lake	627	52
Total	31,248	1,315

We appreciate the opportunity to comment and trust this information will be taken into consideration by EPA relative to Category V needs for Idaho.

Sincerely,

O. M. Dalke, Coordinator
Municipal Programs

OMD/tlb
cc: James Chamblee

EQUAL OPPORTUNITY EMPLOYER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. O.M. Dalke, Coordinator
Municipal Programs
Department of Health and Welfare
Division of Environment
State of Idaho
Statehouse
Boise, Idaho 83720

RE: Draft Report on 1976 Needs Survey
for Combined Sewer Overflows and Stormwater

Dear Mr. Dalke:

Thank you for your letter of December 29, 1976, which reports population and the associated acreage of combined sewer areas in Idaho.

We have included these data in our final computer run. The resulting cost estimate for Idaho for Category V is $8.569 million and for Category VI is $8.855 million.

The final report, including all comments received from the States, will be forwarded to you in early February, 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Coughlin, USEPA Region X
Needs Survey Coordinator

Illinois Richard H. Briceland, Director
Environmental Protection
2200 Churchill Road, Springfield, Illinois 62706 Agency
Telephone: 217/782-1696

November 29, 1976

Mr. James Chamblee, Chief,
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S. W.
Washington, D. C. 20460

Dear Mr. Chamblee:

This letter is in follow-up to our discussions at the meeting held in Chicago on November 16 for discussion of the "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" draft report. At that meeting, we expressed several comments concerning both the basic approach to the 1976 Needs Survey for Categories V and VI, and the draft report prepared by your agency's contractors.

With regard to the latter set of comments, we have compiled readily available data primarily from Section 201 Facilities Plans, and have concluded that the estimate of Category V needs for Illinois is grossly understated. Inasmuch as we were able to identify several significant errors in input data listed in the draft report, this difference in dollar estimates may not reflect serious problems with the contractors' methodology so much as it indicates easily correctible data source problems. We have provided corrected data as well as the available 201 plan dollar estimates for Category V needs for Illinois in the attached report entitled "Combined Sewer Needs in Illinois Urban Areas". We will withhold judgement on the adequacy of your contractors' methodology and on the validity of the state-by-state results for Category V until we have an opportunity to compare the revised results reflecting corrected data with the findings of the 201 Facilities Plans.

One general comment regarding the methodology used by your contractors should be made now, however, because it does not pertain to the data problems mentioned above. We recognize that the degree of combined sewer overflow control contemplated by the contractors is generally consistent with the recent policy direction taken by the U.S. Environmental Protection Agency in its administration of the construction grants program. It is, for example, consistent with the thrust of Program Guidance Memorandum No. 61, which governs grant eligibility of combined sewer overflow control projects. The point which we wish to make here is that the recent federal policy direction in the area of water quality standards has not been consistent with that taken in the construction grants area. For example, the recently released guidance under Section 304(a), "Quality Criteria for Water", suggests a water quality criterion for recreational waters of 200 fecal coliform organisms per 100 milliliters of water. Such a level of quality will not be generally attained in those Illinois waters affected by combined sewer overflows if only the controls contemplated in the contractors' draft report are implemented. In other words, while the degree of control contemplated in the report may represent the maximum level that can be justified pragmatically, it will not be adequate to achieve the "fishable/swimmable" standards set forth in Section 101(a), as defined in detail in "Quality Criteria for Water". This serious inconsistency in policy on the part of the USEPA must be reconciled if the overall program established under P.L. 92-500 is to retain integrity and credibility in the eyes of the public, and in particular the affected municipal officials and their consulting engineers.

With respect to Category VI needs, we have no major objection to the methodology or results described in the draft report prepared by your contractors. Since we have little solid information in the form of detailed studies with which we can compare the Category VI results, we are unable to form any opinion as to the validity of the findings. The methodology seems reasonable if reliable data are used. We are reluctant to endorse total reliance on dissolved oxygen and suspended solids as criteria for determining water quality impacts of urban stormwater runoff, because of documented problems with heavy metals, toxic materials, and other constituents of urban runoff. Yet, we have no practical methodology to suggest as an alternative; therefore, we simply urge that your report note this weakness explicitly as one for which currently available data and methodology offer no apparent solution, and consequently the 1976 Needs Survey results for Category VI should be viewed as being no more than a "best guess". This problem should be largely corrected by the studies currently under way or about to be started pursuant to Section 208.

An additional data item which was discussed during the meeting of November 16, 1976 is the data item of "Appendix B - Base Data for Needs Estimation Model for Urban Runoff" of the contractors report. On page B-12, Chicago is shown as discharging to a large lake. This item was discussed and we understand has been corrected. We wish to emphasize, however, that the Chicago urban area discharges to the Illinois Waterway System which should be treated as an impounded river because of the navigation controls and sluggish flows. We feel a K_2 (day $^{-1}$) of 0.08 should be used for the Chicago area.

We offer the above comments and attached report for your consideration in the preparation of your final documents. If you have any questions, please do not hesitate to contact us.

Very truly yours,

Thomas G. McSwiggin

Thomas G. McSwiggin
Illinois Needs Survey Director

TGM/DJG/sf
Attachment
cc: Philip H. Graham
Robert F. Holbrook
Michael Mauzy
L. D. Hudson
D. J. Goodwin

COMBINED SEWER CONTROL NEEDS IN

ILLINOIS URBAN AREAS

The Illinois Environmental Protection Agency has completed a study of Illinois Urban Areas to determine the total present combined sewer acreage in each. This study was carried out to check the accuracy of the figures contained in the "Draft 1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges", relating to the acreage of combined sewers in Illinois Urbanized Areas.

To arrive at these figures, Agency staff consulted existing 201 facilities planning documents, or contacted consulting engineering firms engaged in the preparation of 201 planning documents. Findings of this study are presented in Table 1, in comparison with the figures published on page B-4 of the draft Needs Survey.

As indicated in Table 1, the actual present combined sewer acreage for Illinois Urbanized Areas totals 295,000 acres, some 28% more acreage than indicated in the Survey of Needs Report.

In conjunction with this study, the Illinois EPA compiled a list of dollar needs from State approved 201 facilities plans for the above communities. These data are presented in Table 2. The combined sewer dollar needs were determined by this method for 89.4% of the total acreage, or 263,900 acres. The total dollar needs for this portion of the whole, as derived from facilities plans, came to $1,871,200,000. (These dollar figures were as reported at the time of 201 plan approval. It was not possible to adjust them to January, 1976 levels within available information and time constraints.)

If it is assumed that the combined sewer needs in the remaining Urban Areas will be proportional in cost to those which have already had needs identified by 201 facilities plans, then total combined sewer needs in Illinois Urbanized Areas alone are projected to be $2,092,400,000.00.

The draft Survey of Needs Report indicates in Table 8.3 that the current capital needs in Illinois Urbanized Areas stands at $774,571,000. This amounts to only 41.4% of the total needs already arrived at in the existing 201 facilities plans for 89% of the Urbanized Area combined sewers, and only 37% of the total predicted needs for these Urbanized Areas assuming that unidentified needs will be proportional to those already clearly identified in 201 planning.

TABLE 1. Acreage of Combined Sewer Areas in Illinois Urbanized Areas

Urbanized Area	Communities with Combined Sewers	Actual Combined Area in 1,000 Acres	Area Reported in Needs Survey reported in 1,000 Acres
Aurora	Aurora	4.3	0
Bloomington	Bloomington	3.0	
	Normal	1.0	
	TOTAL	4.0	0
Champaign	None	0	0
Chicago	MSDGC	240.0	
	Addison	.2	
	Villa Park	1.3	
	Lombard	.9	
	Elgin	1.3	
	TOTAL	243.7	204.9
Davenport Metro	Rock Island	1.0	1.9
Decatur	Decatur	7.2	6.5
Dubuque Metro	None	0	0
Joliet	Joliet	9.0	0
Peoria	Peoria	2.9	14.8
Rockford	None	0	0
Springfield	Springfield	8.1	2.9
St. Louis Metro	East St. Louis	3.8	
	Madison County	2.7	
	Belleville	2.3	
	Wood River	1.0	
	Alton	3.3	
	TOTAL	13.1	0
Kankakee	Kankakee	1.4	
	Bradley	.4	
	TOTAL	1.8	Not reported
	TOTAL COMBINED SEWER ACREAGES	295.1	231

TABLE 2. Combined Sewer Needs for Urbanized Areas, derived from State Approved 201 Facilities Planning Documents

The dollar needs are expressed below for each Urbanized Area in millions of dollars. These dollar needs were extracted from facilities plans as presented, and have not been converted to January, 1976 dollars. Also, no adjustments have been made to reflect construction grants awarded either prior to 201 plan preparation or subsequent to January, 1976.

Urbanized Area	Needs in Millions of Dollars for Combined Sewer Areas
Aurora	9.2
Bloomington	Not Available
Champaign	0
Chicago	1,804.1
Davenport Metro	Not Available
Decatur	Not Available
Dubuque Metro	0
Joliet	Not Available
Peoria	23.5
Rockford	All combined sewers now separated
Springfield	15.3
East St. Louis	14.7
Kankakee	4.4
TOTAL	1,871.2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Thomas G. McSwiggin
Illinois Needs Survey Director
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. McSwiggin:

Thank you for your letter of November 29, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and sotrmwater control (Categories V & VI).

In regard to your general comment relating to control levels evaluated under the draft report and water quality standards promulgated by Section 304(a) of P.L. 92-500, the control levels to be evaluated in the final report have been increased such that for the aesthetics and the fish and wildlife criteria the design storm for combined sewer systems is the 90 percentile storm and for the recreation criteria the design storm is the 98 percentile storm. It is our feeling that this higher level of control will have a high likelihood of maintaining of the fishable, swimmable standards in the receiving waters.

The combined sewered areas of the urbanized areas in the State of Illinois were changed to reflect the information provided in your letter. Additionally, the receiving water classification for Chicago has been changed to reflect discharge to an impounded river. For your information, although Kankakee is an SMSA, it is not an urbanized area and as such was not included in the computer based methodology. Needs for Kankakee and other non-urbanized areas in the State of Illinois are estimated for Category V, however, and are included in the total estimated needs for combined sewer control of each state.

These changes result in a total estimated Category V need to meet the recreation criteria in the State of Illinois of $2585.508 million of which $2154.244 million is for urbanized area needs. These numbers compare very favorably with your state approved 201 Facilities Plans for the urbanized communities of Illinois, that were mentioned in your letter.

The final report, including all comments received from the states will be forwarded to you in early February, 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ted Horn, USEPA Region V
Needs Survey Coordinator

Needs Sur
12/23/76

State of Kansas . . . ROBERT F. BENNETT, *Governor*

DEPARTMENT OF HEALTH AND ENVIRONMENT

DWIGHT F. METZLER, *Secretary*
Topeka, Kansas 66620

November 29, 1976

Mr. John T. Rhett
Deputy Assistant Administrator
Water Program Operations (WH-546)
United States Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

Attention: Mr. James Chamblee (WH-547)

Dear Mr. ~~Rhett~~ Jad:

I am writing in response to your request for comments on the draft "1976 Survey of NEEDS" for categories V and VI.

At the recent review meeting in the Region VII Office (11/22/76) several points of a general nature were offered for consideration. e.g.-

a) A 5 year 24 hour storm as a design guide considers less potential storm flow than standard practice has used, and the 80% occurrence depth of rainfall further reduces design requirements. Might a 10 year 24 hour storm with 90% or 95% occurrence depth of rainfall be more representative of current design practice?

b) Combined sewers that were designed as such may have, since their initial installation, come into use as transporters of sewage collected outside the area originally served. Correction may incur either a category IVB cost to intercept present tributary suburban collectors, or a larger construction project than suggested by consideration of the principal service area (for category V). We recommend that at least a telephone survey of study sites with combined sewers be made, to develop a factor in the model to allow for this effect.

c) The rather narrow definition of category IIIA in the 1976 Survey of NEEDS for categories I-IVB, and the similarly narrow definition of category V in this survey, may have defined some NEEDS out of the overall survey. We believe this to be the case in Kansas.

d) The cost estimates in this review appear to have been minimized. This cost cutting may not have been applied uniformly within the model. Since an indication of relative NEEDS is the desired result, a more flexible cost estimation scheme may provide a better basis for the desired ratios.

e) Other specific comments addressing primarily typographical errors were offered to Philip Graham at the meeting.

We look forward to receiving a listing of the 1976 NEEDS Survey results for categories I through IVB, which you indicated would be sent soon. The two surveys may each (I-IVB and V,VI) have been done on their own consistent basis, but we must assure ourselves that they fit together.

Please address your questions or comments in this regard to:

Jon M. Rueck, P.E.
Water Quality Planning & Surveillance
Division of Environment
Kansas Department of Health & Environment
Topeka, Kansas 66620

Sincerely yours,

Melville W. Gray
Director of Environment

JMR/hi

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

10 JAN 1977

Mr. Jon M. Rueck, P.E.
Water Quality Planning & Surveillance
Division of Environment
Kansas Department of Health and Environment
Topeka, Kansas 66620

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Rueck:

We appreciated receiving Mr. Gray's letter of November 29, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to the comment regarding the use of a 10-year 24-hour design storm, the design storm to be evaluated in the final report has been increased. For the aesthetics and the fish and wildlife criteria, the design storm for combined sewer systems is the 90th percentile storm, and for the recreation criteria, the design storm is the 98th percentile storm. It is our feeling that this higher level of control will enable maintenance of the fishable, swimmable standards in receiving waters.

The area actually served by combined sewers was used to determine Category V needs. Needs for transporting separate sanitary flow which is tributary to a combined sewer system should be included in Category IVB.

There was no intent to eliminate legitimate needs out of the 1976 Survey. Required correction of overflows due to dry weather infiltration in combined systems is included in Category V. Therefore, all flow conditions in combined systems are considered.

Cost curves utilized in the draft report have been modified significantly for the final report, as was discussed in the November 27, 1976 meeting in Kansas City.

The resulting equations increase the Kansas needs estimates for Category V from $43,522 million to $110.401 million.

The final report, including all comments received from the states, will be forwarded to you in early February.

If I can be of further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Walter Robohn, USEPA Region VII
Needs Survey Coordinator

State of Kansas . . . ROBERT F. BENNETT, *Governor*

DEPARTMENT OF HEALTH AND ENVIRONMENT

DWIGHT F. METZLER, *Secretary*

Topeka, Kansas 66620

January 7, 1977

Mr. Philip H. Graham, P. E.
Project Officer, Needs Assessment Section
Facility Requirements Branch (WH-547)
U.S. Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

Re: 1976 Needs Survey

Dear Mr. Graham:

Thank you for returning my call of 1/7/77. To confirm our conversation, your telephone conversation notes of a contact of Bill Boggess at Kansas City, Kansas by Wen Huang indicate that a misinterpretation was initially made in the base data. The notes indicated 4000 acres of combined sewers for Jersey Creek as being 50% of Kansas City's combined sewer area. The draft report showed 4000 acres as the total on page B-6 rather than more properly indicating 8000 acres. I appreciate your offer to make this small change in the last computer run prior to presentation of the final report, or at least if that is not possible, to provide documentation of the initial misinterpretation.

I look forward to your response to a letter of 11/29/76 from M. W. Gray, which we also discussed.

Please inform Jim Chamblee that while we have not exhaustively reviewed the EPA-1 forms for the survey on the other categories, a spot check has shown them to resemble what we submitted. Should the opportunity for it arise, I would like to have a summary of the Kansas EPA-1 forms, at least on items 15 and 16.

Since I will be involved in the 208 planning activities, specifically with model selection, I hope we can discuss the category V and VI methodology in greater detail after you have made your report to Congress.

Sincerely,

Division of Environment

Jon M. Rueck

Jon M. Rueck, P.E.
Water Quality Planning and
Surveillance Section

JMR:nb
cc: Walter Robohn, Regional
Needs Survey Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

18 JAN 1977

Mr. Jon M. Rueck, P.E.
Water Quality Planning and
Surveillance Section
Department of Health and Environment
State of Kansas
Topeka, Kansas 66620

RE: Draft Report on 1976 Needs Survey
for Combined Sewer Overflows and Stormwater

Dear Mr. Rueck:

Thank you for your letter of January 7, 1977, reporting the 8000 acre combined sewer area for your State's portion of the Kansas City urbanized area. Our Region VII Office has stated that the population figure of 76,000 persons used in our draft report for this area is correct.

We have included these data in our final computer run. The resulting cost estimates for Kansas are $107.961 million for Category V and $124.876 million for Category VI.

The total cost estimates for the Kansas City, Kansas combined sewer area increased but the average cost of control per acre decreased due to the reduced population density derived from the new estimate of area. Because our methodology utilizes the urbanized area control costs per acre to estimate the control costs for the combined sewer areas located in the non-urbanized areas of the State, the non-urbanized area cost estimates decreased. The result was a small overall decrease in the total EPA cost estimate for Category V. The cost estimate for Category VI also was reduced slightly because the area previously estimated to be served by separate storm sewers was reduced by the 4000 acres you informed us were actually served by combined sewers.

The final report, including all comments received from the States, will be forwarded to you early in February, 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Walter Robohn, USEPA
Region VII, Needs Survey Coordinator

State of Maryland

DEPARTMENT OF HEALTH AND MENTAL HYGIENE
ENVIRONMENTAL HEALTH ADMINISTRATION
P.O. BOX 13387
201 WEST PRESTON STREET
BALTIMORE, MARYLAND 21203
PHONE • 301-383-2365

NEIL SOLOMON, M.D., PH.D.
SECRETARY

DONALD H. NOREN
DIRECTOR

November 30, 1976

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S.W.
Washington, D.C. 20460

Dear Jim:

In line with the discussions held in Environmental Protection Agency Region III headquarters in Philadelphia on November 17, 1976 with Mr. Philip Graham and other members of your staff, I am hereby transmitting additions to your base input data for the State of Maryland in Categories V and VI of the 1976 Survey of Needs.

The first enclosure pertains to Category V, Combined Sewer Overflows. The list includes eight communities identified by their facility number along with the acreage involved and the estimate of respective needs necessary for the correction of combined sewer overflows. These communities were not included in the draft report on needs in Category V and VI as prepared by your consultants. It should be noted that the listed costs are in June 1973 dollars as reported in the 1974 survey, and I request that you adjust them to reflect appropriate 1976 dollars.

As far as Category VI is concerned, the methodology employed and the assumptions made to estimate needs for the nation does not accurately reflect the needs of this area. Specifically, the draft estimate report grossly underestimates, and in most cases, neglects the needs associated with the requirement for the protection of shellfish waters. Your agency recognized the special problems affecting the Chesapeake Bay and the corresponding stringent treatment requirements necessary for the protection of shellfish waters, as indicated by the first paragraph on page 9 of your final report to Congress of the 1974 "Needs" Survey.

For this reason, I am submitting a special report for Category VI needs (storm water treatment) and the accompanying study by Gannett Fleming Corddry and Carpenter, Inc., prepared for the State of Maryland for the 1974 submission for Category VI. Again, the costs have to be adjusted to 1976 dollars. The estimates are specific for Maryland and, therefore, more accurately reflect our needs as compared to the general draft report prepared for you by your consultants.

Thank you for the opportunity of reviewing your draft report on needs in Category V and VI, thereby enabling us to make the necessary additions.

Warmest personal regards,

Sincerely yours,

Max Eisenberg

Max Eisenberg, Ph.D.
State Needs Survey Director

ME:kn

cc: Dr. Neil Solomon
Mr. Donald H. Noren
Dr. Benjamin D. White
Mr. Kenneth Pantuck - EPA Region III

Enclosures

1976 UPDATE

CATEGORY V

COUNTY	FACILITY NUMBER	CORRECTION OF OVERFLOW NEEDS		ACRES
Allegany				
	31001	14,000,000	Cumberland	2160
	32001	6,784,000	Frostburg	1040
	97001	1,600,000	Westernport	250
Anne Arundel				
	04001	10,000	City of Annapolis	1.5
Baltimore City				
	01002	1,290,000	Patapsco	200
Dorchester				
	46001	2,437,000	Cambridge	330
Wicomico				
	84001	1,020,000	Salisbury	175
Worcester				
	89001	300,000	Snow Hill	45

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] 1977

Dr. Max Eisenberg, Ph.D
State Needs Survey Director
Maryland Department of Health and Mental Hygiene
Environmental Health Administration
Post Office Box 13387
Baltimore, Maryland 21203

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Max:

Thank you for your letter of November 30, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your comment on Category V, the areas served by combined sewers mentioned in the attachment to your letter have been included in the final report. These inclusions provide a total Category V need for the recreation criteria of $47.460 million.

As far as Category VI is concerned, your comment regarding an inclusion of non-urbanized areas for stormwater control needs was voiced by several states although not all were interested in the shellfish standards. Regulations for the application of the NPDES Program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI. The term "separate storm sewer" is defined as "A conveyance or system of conveyances...... located in the urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff". The permit issuing authority may designate other storm sewers as being a significant contributor of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

Reproduced from best available copy.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
CARL T. JOHNSON
E. M. LAITALA
DEAN PRIDGEON
HILARY F. SNELL
HARRY H. WHITELEY
JOAN L. WOLFE
CHARLES G. YOUNGLOVE

WILLIAM G. MILLIKEN, Governor
DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
HOWARD A. TANNER, Director

December 14, 1976

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S.W.
Washington, D.C. 20460

Re: Comments On "Draft, 1976 Survey of Needs for Control Of Pollution From Combined Sewer Overflows And Stormwater Discharges"

Dear Mr. Chamblee:

This is in response to Mr. Rhett's letter of October 22, 1976, to Dr. Howard Tanner, Director, Michigan Department of Natural Resources, soliciting comments on the above referenced report.

The Draft of the 1976 Needs Survey for the control of storm and combined sewer discharges presents dollar figures which, in our view, are extremely low. We cannot argue with the relative percentages of the national total for each state, however, the total dollars identified as necessary to meet the provisions of PL 92-500 do not appear realistic and should not be represented to Congress as the total cost to solve all combined and storm sewer water quality related problems.

We offer the following specific comments regarding the report:

1. There are limitations in the Draft on assumptions, methodology, data base and the relationship to Categories I thru IV.
2. By limiting communities that need stormwater control to the census definition of an urban area, a substantial portion of the national need is eliminated from Category VI.
3. There are areas of the country where the dissolved oxygen (DO) levels used would be insufficient for maintenance of Water Quality Standards. The Recreation Criteria in the Draft uses a daily average of 5.0 mg/1 and no less then 4.0 mg/1 at all times. Michigan's existing, and federally approved, Water Quality Standards call for a minimum of 6 mg/1 DO in all Great Lakes and connecting waterways, and in all inland streams designated for coldwater fish.

MICHIGAN
R1026 1/76

4. The maximum allowance of 400 mg/l suspended solids seems in our estimation to be extremely high. At these levels there would most certainly be settlable solids which would result in sludge deposits contrary to Water Quality Standards and violations of the non-degradation provisions of the standards.

5. Because the '76 Survey was done in two parts, by two contractors, there appears to be some confusion on what is needed to be included in Categories I thru IV, specifically the cost for storm and combined sewer interceptors. This cost was not included in Categories I thru IV, because it related to Categories V and VI, and we find that in the Draft, Categories V and VI contained no transportation costs. We believe all 6 Categories should be coordinated more closely.

6. The water quality parameters considered for both combined sewer and storm sewer control include only suspended solids, dissolved oxygen, and bacteria. As listed in the Draft, there are other parameters that affect water quality: nutrients, dissolved solids, metals and pesticides. These parameters can have a significant effect on water quality and should be included in the cost evaluation for storm/combined sewer controls.

7. Operating costs were estimated on the basis of 0.03¢ per kilowatt hour for electric power. We believe that future power costs will increase dramatically. It seems reasonable to assume that this factor alone will increase operating costs, as well as other costs, significantly.

8. It appears that only rarely was disinfection included in storm water control, even for the Recreation Category. This was because disinfection was apparently only included in those few cases when DO problems would result in the need for a structural control system to remove biochemical oxygen demanding substances. There could be gross violations of Water Quality Standards where disinfection is required to protect total body contact recreation.

9. The Category I thru IV needs for '76 were determined by reviewing, within resource constraints, reports on cost. This seems a fairly reasonable approach, although it also has some drawbacks. Among others, in some categories, if no report were available, no need could be reported. This, it must be recognized, does not mean that a need does not exist.

10. Modeling is a valuable tool, however, the model should be flexible enough to take into account the different water quality requirements throughout the country.

11. Additional parameters should be considered, as needed. The influence of these parameters should be researched.

We have cited the above to illustrate our concern that the assumptions, and methodology used cannot reflect the total needs for the nation. In looking at NPDES Permits, Water Quality Standards, and Construction Grants Programs, it appears that these programs are not going in the same direction. To illustrate this, we cite the DO provisions of this Survey (Grant Program) and the fact that we are in the process of upgrading our Water Quality Standards. We are considering a minimum DO of 7 mg/l for streams supporting coldwater fish, a level that has been encouraged and officially supported by EPA. It seems reasonable that if Congress is not willing to fund the programs necessary to meet the provisions of 92-500 as presently written, that Congress should amend 92-500 to reflect the realities of current achievability.

As far as basic data is concerned, we generally support the data included, but believe that there were not enough communities indicated in the determination. We have attached a copy of the report done for Michigan's 1974 Survey for treatment and control of stormwater. We also have included the 1974 Survey form for Category V, for Detroit. These reports are included to illustrate our position that the needs for the '76 Survey are too low. It is our opinion that, at least for Michigan, the real needs are reflected in this '74 Survey.

Michigan, in general, has flat topography and high groundwater tables. These two factors increase construction costs for both retention structures and transportation systems. These factors are not reflected in cost indices used in the cost calculation and, therefore, we question their validity.

As indicated previously, stormwater control for communities in the urban areas were not included as a need. Further, although there was some "area" included for control of combined sewers, it is not clear to what extent, and what communities were included in this "area".

The next storm/combined needs survey should be directed at the results of individual facility plans, which reflect the most realistic cost data available. Hopefully, there will be many more facility plans completed when the next survey is necessary.

To reiterate our position, the Draft '76 Survey reflects costs for Categories V and VI that are low as a national total. It is our opinion that the results of our '74 Survey for Categories V and VI are much closer to the real costs, at least for Michigan, and probably for the nation. Future surveys should address specific Water Quality Standards, and input from the states should be solicited early in the process and more time given for review of the draft report.

We thank you for the opportunity to comment on the Draft 1976 Survey of Needs For Control Of Pollution From Combined Sewer Overflows And Stormwater Discharges. We look forward to working with you in the future in determining realistic estimate of needs.

Very truly yours,

ENVIRONMENTAL PROTECTION BUREAU

W. G. Turney
Bureau Chief

WGT:ss

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] 1977

Mr. W. G. Turney
Bureau Chief
Environmental Protection Bureau
Michigan Department of Natural Resources
Stevens T. Mason Building
Lansing, Michigan 48926

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Turney:

Thank you for your letter of December 14, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

Your comments regarding limitation of Category VI needs to urbanized areas was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

The regulations defined the term "separate storm sewer" as "a conveyance or system of conveyances .... located in an urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for urbanized areas only.

The water quality criteria identified in the draft report were for wet weather conditions. Additionally, one nationwide set of criteria was required due to budget limitations and the need for a nationally consistent estimate. It is our feeling that, based on available information, the proposed criteria will support the specific uses in and below urban areas and will not result in sludge deposits. Several of your comments request consideration of additional parameters on a site specific basis, such as additional pollutants (nutrients, dissolved solids, metals, and pesticides), construction costs (high groundwater conditions), power costs, and detailed information from facilitiy plans. Each of these parameters was considered in the early stages of the needs survey development, but was rejected either because of lack of a national data base or time and budget constraints on the project.

In the assumptions for meeting the recreation water quality criteria, all combined sewer overflows received disinfection and any stormwater discharge which required structural control systems also received disinfection. These considerations, plus increasing the design storm for combined sewer control to the 98th percentile storm (as we have done for the final report to Congress) should protect receiving waters for body contact recreation use. Costs were included in the final Category V and VI estimates for intercepting wet weather discharges and conveying them to centralized treatment facilities where treatment was assumed necessary.

A table will be included in the final report listing the combined sewered acreage considered outside urbanized areas. A total of 33,300 acres of combined sewered area was included for the State of Michigan outside of Census defined urbanized area.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ted Horn, US EPA Region V
Needs Survey Coordinator

12/23

Minnesota Pollution Control Agency

December 13, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street Southwest
Washington, D. C. 20406

Re: Draft 1976 Needs Survey
for correction of Combined
Sewer Overflows and Storm
Sewer Discharges

Dear Mr. Chamblee:

The Minnesota Pollution Control Agency (MPCA) thanks you for the opportunity to review and comment on this report.

As you requested, we have focused our efforts on the "Base Input Data" located in Appendix B. That data appears to be accurate, as far as hydrologic and general population data is concerned. The Twin Cities Metropolitan Waste Control Commission (MWCC) has been conducting studies on the combined sewer overflow areas and associated populations. They have indicated that they would like to comment on that aspect of the data, if they find discernable differences, and will do so by separate letter.

With regard to the methodology selected to prepare the needs data, we generally agree that a nationwide effort would probably result in a means to prorate funding without bias. This approach has taken into account many assumptions which must be made to come up with a result.

While we are not necessarily in disagreement with these assumptions, we are concerned about several of the resulting implications.

Our first concern would be the assumption that results from studies concerning discharges to lakes, rivers, and ocean estuaries can be combined and standard parameters can be derived for use in all cities regardless of the type or use of the receiving water to which they discharge. It is a fact that treatment needs may vary greatly with the type and use of the receiving water.

1935 West County Road B2, Roseville, Minnesota 55113
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The second area of concern would be the use of a design storm to treat 80 percent of the rainfall caused overflows. The method at which this design storm was arrived appears to assume that all precipitation nationwide occurs in the form of rainfall. We are concerned in Minnesota, especially in the Twin Cities areas, not only about rainfall caused discharges, but the major volume of runoff caused by spring melting of the snow accumulated through the winter. This is generally a mass loading at a time the Mississippi River is at a very low flow and the discharge would probably equal or exceed the existing river flow. This, in fact, may be the critical pollution time of the year. The report, as prepared, does not consider this aspect. We would suggest that the report should evaluate a summer rain design storm, as compared to a spring runoff situation, as it actually occurs in most northern states.

Other than these concerns, it would appear that the many assumptions made would probably affect most of the cities in a similar manner. We would ask that you remember that these are assumptions which may or may not be true in every case and the Environmental Protection Agency (EPA) consider funding on a basis of needs that are shown in the actual studies to be prepared for the individual areas concerned.

As a final note, we would like to point out that we have at least six other cities (Mankato, Winona, Little Falls, New Ulm, Red Wing, and Crookston) that did not meet the 50,000 population criteria, as an urban area, but still may need to provide treatment for combined sewer overflows.

Should you have any questions about these comments, please call Mr. Gordon Wegwart at (612) 296-7309.

Sincerely

Peter L. Gove
Executive Director

PLG:mlj
cc: Mr. Richard Dougherty, Metropolitan Waste Control Commission, St. Paul

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

10 JAN 1977

Mr. Peter L. Gove
Executive Director
Minnesota Pollution Control Agency
1935 West County Road, B-2
Roseville, Minnesota 55113

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Gove:

Thank you for your letter of December 13, 1976, offering comments on our draft report which estimated needs for combined overflows and stormwater control (Categories V & VI).

We agree that the type of receiving water greatly influences the required level of control of pollutants. The use of the quality parameter to evaluate requirements for pollution control was developed after reviewing many other relationships. The resulting quality parameter, which includes pollutant levels from combined sewers, storm sewers and existing treatment facilities, the receiving water discharge, and the reaeration coefficient (K_2), provided the best correlation of the available information. The methodology is not intended to define the percentage of pollutant removal required for a specific area, but to generally define areas which require higher levels of control than other areas for a nationally consistent estimate of needs.

The evaluation of snow melt runoff from urban areas was considered in the early stages of the needs survey development. However, no nationwide methodology could be developed to evaluate the volume and/or duration of snow melt conditions. Therefore the resultant methodology utilizing runoff from rainstorms was developed.

The resultant needs survey numbers for urbanized areas should not be utilized to consider funding for individuals areas. The intent was to provide relative state-by-state needs and a percentage of total national needs only.

A total of 11,900 acres of non-urbanized combined sewered area was included in the draft and final report for the State of Minnesota. This acreage should be adequate to consider the six cities mentioned in your comment letter.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section (WH-547)

cc: Ted Horn, US EPA Region V
Needs Survey Coordinator

STATE OF NEVADA
DEPARTMENT OF HUMAN RESOURCES
CAPITOL COMPLEX
ROOM 600, KINKEAD BUILDING
505 E. KING STREET
CARSON CITY, NEVADA 89710
TELEPHONE (702) 885-4730

MIKE O'CALLAGHAN
GOVERNOR
ROGER S. TROUNDAY
DIRECTOR

DEPARTMENTAL
DIVISIONS
AGING SERVICES
CHILD CARE SERVICES
HEALTH
MENTAL HYGIENE-
MENTAL RETARDATION
REHABILITATION
WELFARE
YOUTH SERVICES AGENCY

November 17, 1976

James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S.W.
Washington, D. C. 20460

Dear Mr. Chamblee:

Thank you for the opportunity to comment on the Draft Report of the "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges." I can appreciate the time constraints under which the study was conducted and the necessity to limit the number of quality parameters that could be used for various reasons for modeling, but I feel the report is not truly indicative of the needs in Nevada.

While only two streams were considered for Nevada, the quality of the water in the streams, the length of the reaches and receiving waters are of entirely different natures and will have to be considered independently with more stress on nutrient input before the true needs can be determined.

I have no comments on the computer program methodology presented in Appendix C, but the streamflow (page B-15, no. 277) for Las Vegas is 79 cubic feet per second and not the 18 cfs indicated in Appendix B.

Again in Appendix B, using the same stream classification for the two waters is unrealistic due to the quality of the streams.

Sincerely,

Roger S. Trounday

Roger S. Trounday
Director

RST/jr

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

22 NOV 1978

Mr. Roger S. Trounday, Director
Department of Human Resources
Capital Complex, Room 600
Kinkead Building
505 East King Street
Carson City, NV 89710

Dear Mr. Trounday:

Thank you for your comments on our draft report on needs for combined sewer overflow and stormwater control (Categories V and VI).

Your comments are being studied carefully and will be taken into consideration in our final report to the Congress.

We are sorry that we cannot yet comment on the issues your letter raised. These are under study, along with comments from other states and territories.

As soon as possible, a complete explanation of our final cost estimates will be forwarded.

Sincerely,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Roger S. Trounday, Director
Nevada Department of Human Resources
Capitol Complex
Kinkead Building, Room 600
505 E. King Street
Carson City, Nevada 89710

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Trounday:

Thank you for your letter of November 17, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The input data for the Las Vegas urbanized area has been changed from the 18 cfs indicated in the draft report to the 79 cfs mentioned in your letter. As you mentioned, the time and budget constraints of the contract limited the detail of the evaluations for each urbanized area. However, the methodology does provide a uniform basis for allocating needs to the states for stormwater control problems. Upon completion of the 208 studies presently underway and other stormwater water studies, a more detailed data base can be developed for use in future needs surveys.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Rock, USEPA Region IX
Needs Survey Coordinator

STATE OF NEVADA
DEPARTMENT OF HUMAN RESOURCES
ENVIRONMENTAL PROTECTION SERVICES
CAPITOL COMPLEX
CARSON CITY, NEVADA 89710

November 23, 1976

James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S.W.
Washington, D.C. 20460

Re: 1976 Survey of Needs for the Control of Pollution From Combined Sewer Overflows and Stormwater Discharges (Draft)

Dear Mr. Chamblee:

Nevada's Environmental Protection Services has reviewed the subject document and has the following comments concerning it:

1. As is typical of federal studies of this nature, a "broad brush" technique was used in an effort to apply the assessment methodology uniformly to all states. This approach frequently results in inequities because features which are unique to each state are not considered in the assessment. Numbers developed in this manner frequently come back to haunt us when an accurate assessment is made. As an example, Nevada's needs are based on the needs of the Reno-Sparks and Las Vegas areas, but our most critical needs to control urban runoff are in the Lake Tahoe Basin. Although the communities in the Basin are relatively small, the costs for stormwater control are relatively high, because of the terrain, climate, high quality of waters to be protected, and the stringent controls placed on construction activities in the Basin.

2. I believe that input from the states is essential in order to produce a valid study. As a minimum each state should have had an opportunity to review the data and methodology

A section of the Bureau of Environmental Health

used to evaluate their needs. I hereby request copies of the data and calculations used to assess our needs, so that we can adequately review the results of this study.

3. A table listing abbreviations and symbols would be handy for quick reference.

Yours truly,

James B. Williams, Jr.

James B. Williams, Jr., P.E.
Construction Grants Officer

gm

xc: Wendell D. McCurry, Environmental Protection Services
John Wise, EPA, Region IX
Bob Rock, EPA, Region IX

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. James B. Williams, Jr., P.E.
Construction Grants Officer
Environmental Protection Services
Nevada Department of Human Resources
Capitol Complex
Carson City, Nevada 89710

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Williams:

Thank you for your letter of November 23, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

Your specific comment requesting inclusion of non-urbanized areas for stormwater control needs was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program which it established were utilized to determine the areas requiring needs in Category VI. In the regulations, the term "separate storm sewer" is defined as "A conveyance or system of conveyances....located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

Within the time constraints of the project, every effort was made to allow state input and review of the 1976 Needs Survey. An early draft report documenting the methodology utilized to the estimated needs and the input data required by this methodology were sent to the states for their comments. A listing of abbreviations and symbols is given on page x through xiii of the draft report. It was unfortunate but unavoidable that more time was not available for state review of the draft report.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Rock, USEPA Region IX
Needs Survey Coordinator

The State of New Hampshire

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Director of
Municipal Services

Water Supply and Pollution Control Commission
Prescott Park
P.O. Box 95—105 London Road
Concord 03301

November 30, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facilities Requirements Branch (WH-547)
401 M Street, Southwest
Washington, D. C. 20460

Subject: Needs Survey, Categories V and VI

Dear Mr. Chamblee:

We have briefly reviewed the draft report entitled, "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges". The following comments are offered:

1. Separation of combined stormwater systems was not evaluated in the report. However, it is our opinion that, for many of the older combined systems, separation is, in fact, the most cost-effective solution. It should be noted that many of our completed facilities plans recommend separation as the most cost-effective alternative (see attached summary).

2. As a corollary to item (1) above, we would like to call your attention to the fact that category IIIB costs were disallowed by Dames & Moore for those combined systems which had excessive flow even during dry weather periods. We were assured by Dames & Moore that these costs would be included under category V costs. We estimate that approximately 15 to 20 million dollars of documented rehab needs have not been included in the overall Needs Survey.

3. On page B-1 of subject report, the Manchester SMSA is reported to have 5.1 thousand acres of combined sewers, whereas, the unpublished report by the APWA (which was used by the Consultant as the data base) shows 7.0 thousand acres of combined

sewers. Mr. Wen Huang of your office informed me that he had personally called the City of Manchester to verify the APWA data and that the City gave him the figure of 5.1 thousand acres. We called Mr. Ted McLeod, City Engineer for Manchester, and he informed us that he had offered to obtain the exact answer from Mr. Huang; however, when pressed for a quick answer, he took a guess and said 5,100 acres. By scaling off the Manchester sewer map, we obtained a total of 7,460 acres of combined sewers. We would suggest that the APWA figure of 7,000 acres be retained and that appendix B of the Consultant's report be changed to reflect the increased acreage of combined sewers.

4. The costs reported for category V are based on treating a design storm of 1.6 times the mean rainfall event [Des. storm = 1.6 x MRF]. It is our opinion that the criteria is not consistent with State water quality standards and may, in fact, be inconsistent with PL 92-500.

This Agency made no attempt to check or verify the numerous empirical equations used in the Consultant's report. In 1974, the Commission Staff made a detailed estimate of category V costs which were directly related to water quality standards. We realize that New Hampshire's relative percentage of total category V costs increased substantially from the 1974 Needs Survey, however, we are firm in our belief that this State's total dollar needs for category V are closer to our 1974 estimate of 191 million dollars than to the Consultant's estimate of 115 million dollars.

We appreciate the opportunity to comment on the draft report, and we trust that our comments will receive your attention.

Very truly yours,

WA Healy

William A. Healy, P.E.
Executive Director

WAH:RAC:bml
CC: Al Peloquin, NEIWPCC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. William A. Healy, P.E.
Executive Director
New Hampshire Water Supply and
Pollution Control Commission
Post Office Box 95
Concord, New Hampshire 03301

RE: Draft Report on 1976 Needs Survey
for Combined Sewer Overflows and
Stormwater

Dear Mr. Healy:

Thank you for your letter of November 30, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In certain specific instances separation of combined stormwater systems may be cost effective. However, there was insufficient data to determine all these instances and the related costs on a nationwide basis. Therefore, treatment and discharge systems were analyzed to provide a cost estimate for control. The control levels were identified such that increased cost would be considered in the areas where higher pollutant removal was required.

Correction of dry weather infiltration in combined sewer systems should be included in Category IIIB, if specific justification for these costs are available. However, we understand that, given the recent revisions to needs estimates in Category V, you are satisfied with the overall results of the 1976 Survey.

In the final report, the combined sewered area of the Manchester urbanized area will show the APWA figure of 7,000 acres and a combined sewered population of 71,000.

After receiving comments from the states, the design storm for combined sewer control was changed to the 90 percentile storm for the aesthetics and fish and wildlife criteria (design storm equals 2.3 x MFR) and the 98 percentile storm for the recreation criteria (DS = 3.91 x MFR).

These and other changes raised the New Hampshire needs estimate for the recreation criteria for Category V to 307.960 million and for Category VI to 131.630 million.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J.A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Charles Pease, USEPA Region I
Needs Survey Coordinator

STATE OF NEW MEXICO
HEALTH and SOCIAL SERVICES department

ENVIRONMENTAL IMPROVEMENT AGENCY
Planning & Regs. Dev. Off.

November 5, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. St., S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

I appreciate your sending the draft of the "1976 Survey of Needs for Control of Pollution From Combined Sewer Overflows and Stormwater Discharges" for our review. In reviewing the base data for New Mexico, I found only two points that I would like to clarify.

The first point is that, the state population projected for 1990 by EPA was changed in May 1976 from the old figure of 1,232,000 to 1,300,000. This new projection was then used by EPA and Dames & Moore for Categories I-IVB of the 1976 Needs Survey.

The second point is that since the 1970 Census, the SMSA containing Albuquerque has been expanded to include all of Bernalillo and Sandoval Counties. In view of this, a change in your population projection for the SMSA in 1990 is also in order.

These then were the only points in your base data for New Mexico that I have any question about. I would, however, also like to mention that there are no combined sewer systems in New Mexico.

Thank you once again for your consideration in sending us a copy of this report. This office will be glad to supply you with any other information that you may require in this regard.

Sincerely,

Cy Butner

Cy Butner,
Needs Survey Chief

CB:opg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Cyrus Butner
Needs Survey Chief
New Mexico Environmental Improvement
Agency
P.O. Box 2348, W.Q. Division
Santa Fe, New Mexico 87503

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Butner:

Thank you for your letter of November 5, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your specific comment, the state population projections for 1990 of 1,232,000, which was published in the Draft Report, was in error and has been changed to 1,300,000. The SMSA population projection for Albuquerque was taken from the 1974 OBERS projections, and was only used to define a growth rate for the urbanized area of Albuquerque. Considering this statement, the exact aerial designation of the SMSA is not important to the needs estimation methodology. The growth factor utilized is the 1990 SMSA population divided by the 1970 SMSA population.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee
James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc. Richard McDermott, USEPA Region VI
Needs Survey Coordinator

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Peter A.A. Berle
Commissioner

November 26, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. St., S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

This is in response to the October 22, 1976 letter from Mr. John T. Rhett transmitting the draft report "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges", October 1976.

Our comments on this report are as follows:

1. No rationale is provided for selecting the 80% storm as the basis of design and analysis (Page 4-10, 2nd full paragraph).

2. The observation "It is beyond the scope of this investigation to undertake detailed .... analyses of the ten study sites ..." is definitely an unreasonable explanation for justifying the analysis (Page 4-10, first sentence in the 2nd full paragraph). Since the ten study sites were chosen, among other factors, for having site specific data, and since the relationship established between Organic Removal Required and Quality Parameter (Figure 6.3) for the ten sites was extrapolated to all 279 urbanized areas, a detailed analysis at these 10 sites was most certainly warranted, and in fact, a necessity.

3. The statement relating to the reaeration coefficient (K_2) to a receiving stream's capacity to accept oxygen demanding material is very questionable since K_1 (deoxygenation coefficient) has been observed to not vary directly with K_2 (Page 6-7, 3rd full paragraph). The use of the relationship to calculate the "quality parameter" which is then applied to all urbanized areas raises serious questions as to the credibility of the water quality analysis for a specific site.

4. Although it is recognized that EPA is attempting to assess needs for these categories on a nationwide basis, the criteria for the three levels of water quality which were used are different from the approved water quality standards for specific receiving waters in the urbanized areas. As an example, toxic substances removal is not considered in the analyses, however, standards criteria do exist for certain class of waters. These differences can result in a significant variation in control strategies, and their cost, on a site-by-site basis.

5. Most assumptions made by the consultant in the methodology are "conservative", leading to an end result which minimizes treatment requirements and costs. Examples of the conservative assumptions are use of the 80% design storm, criteria for the "water quality levels" which are different than approved water quality standards, removal of toxic substances was not considered, monthly average stream flow and quality data rather than critical conditions (i.e., in New York State, Minimum Average 7 day - 10 year low flow), no treatment required (except for street sweeping and fine screening) unless the "water quality level" criteria were violated, simplified stream model used for all areas.

We strongly recommend that you fully qualify the conservative element of the Category V and VI analysis in your report to Congress.

6. The statement "... costs estimated in 1976 are slightly less than one-third of those reported in the 1974 Needs Survey and less than one-half of those in the 1973 Needs Survey" cannot be rationalized with Table 8.4 (Page 8-5, first full paragraph under Section 8.4). We recommend that this statement be clarified.

7. We question the use of the words "eligible costs" in the 2nd line of the paragraph at the top of Page 8-7. In lieu of our previous comments regarding the methodology of analysis, the costs cannot be construed as being "reasonable" and therefore cannot be used for the determination of eligibility. The suggested rewording is "Based on these considerations, ... a more uniform nationwide estimate of the costs for water quality control ... ."

8. We strongly recommend that the phrase " ... a reasonable program for water quality control of combined sewer overflows." be deleted from the draft report and not be used in the report to Congress (Page 8-7, last line of paragraph in Section 8.5). For the reasons contained in this letter, the assessment does not constitute a "reasonable program". We feel it does, however, provide a relationship between state needs and the total national amount for equitable distribution of funds.

To facilitate a more thorough review of the New York State estimate for both Categories V and VI, it is requested that you provide a copy of the computations and the cost data for each urbanized area considered in New York State, including the data for any area which extended into an adjacent state (i.e., the New York Metropolitan area of New Jersey).

Thank you for the opportunity to comment on the report. If you have any questions, please call me at AC518--457-2462.

Sincerely yours,

Albert W. Bromberg

Albert W. Bromberg
1976 Needs Survey Director

BC&E

BLACK, CROW & EIDSNESS, INC.
CONSULTING ENGINEERS
PRINCIPAL OFFICE: 7201 N. W. ELEVENTH PLACE, GAINESVILLE, FLORIDA
REGIONAL OFFICES: ATLANTA, GEORGIA / CLEARWATER, FLORIDA
BIRMINGHAM, ALABAMA / BOCA RATON, FLORIDA / NAPLES, FLORIDA
SAN JOSE, COSTA RICA / PHILADELPHIA, PENNSYLVANIA / MONTGOMERY, ALABAMA

PLEASE REPLY TO:
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CABLE ADDRESS: BCEGNVFLA

November 29, 1976

Mr. W. F. Esmond, Jr., P.E.
Bureau of Sewage Programs
Division of Pure Waters
New York State Dept. of
Environmental Conservation
50 Wolf Road
Albany, New York 12201

Re: 1976 Survey of Needs for
Control of Pollution from
Combined Sewer Overflow
and Stormwater Discharge
Project No. 573-7600-4

Dear Mr. Esmond:

On Thursday, November 18, 1976, you attended a meeting at EPA Regional Offices in New York City concerning the Categories V and VI Needs Survey. At that time you requested additional information regarding the source of urban runoff and combined sewer overflow data listed in Table 4.1 of our draft report for New York, New York and for Brooklyn, New York.

The data for New York, New York are found in the following reference:

> Engineering Science, Inc., and H. F. Ludwig and Associates. "Waste Discharge Characterization Task Report." City of New York, Department of Water Resources, Environmental Protection Administration. May 1971.

The water quality data reported in this reference were obtained from a storm sewered area sampled at the outfall near 199th Street. Runoff from four rain storms and one snow melt event were sampled.

The data for Brooklyn, New York are reported in the following reference:

> Mytelka, A. I., et al. "Combined Sewer Overflow Study for the Hudson River Conference." Environmental Protection Technology Series. EPA-R2-73-152. January 1973.

The water quality data reported in this reference were obtained from a combined sewer outfall lcoated at Johnson Avenue, east of Morgan Avenue in Brooklyn. Sampling was carried out for both dry weather and wet weather conditions. However, only one overflow event was sampled.

The above references were the only sources containing runoff quality information for New York City which we were able to find in the short time allotted to the task. I hope that this information will be of some benefit to you. If you have any additional questions, please let me know.

Very truly yours,

BLACK, CROW AND EIDSNESS, INC.

Ronald L Wycoff

Ronald L. Wycoff, P.E.

RLW/mfl

xc: Mr. R. D. G. Pyne
Mr. Philip Graham

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

11 JAN 1977

Mr. Albert W. Bromberg
1976 Needs Survey Director
New York Department of Environmental
Conservation
50 Wolf Road
Albany, New York 12233

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Bromberg:

Thank you for your letter of November 26, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your specific comments, our responses are as follows:

1. After receiving comments from the states, the design storm for combined sewer control was changed to the 90th percentile storm for the aesthetics and fish and wildlife criteria (DS=2.3 x MRF) and 98 percentile storm for the recreation criteria (DS=3.91 x MRF). The rationale for this selection was to provide a cost-effective level of control and yet have a likelihood of meeting the water quality criteria identified in Section 2.2.

2. The statement quoted from page 4-10 relates to specific types of analyses of the ten study sites. It is our opinion that the analyses which were conducted on the ten study sites were as detailed as could be accomplished within the time and budget constraints on the project. The minimum data base available also restricted the level of detail evaluated in the 1976 Needs Survey. Upon completion of 208 studies and other ongoing work, a more detailed data base may be available for the future needs surveys.

3. The quality paramenter to evaluate the requirements for specific levels of pollution control was developed after reviewing many other relationships, including those utilizing the deoxygenation coefficient (K_1).

The resulting quality paramenter, which includes pollutant loading from combined sewers, storm sewers and existing treatment facilities, the receiving water discharge, and the reaeration coefficient (K_2), provided the best correlation of the available information. The methodology is not intended to define the percentage of pollutant removal required for a specific area, but to generally define areas which require higher levels of control than other areas.

4. We agree that on a site-by-site basis, toxic substances and other pollutants may require higher levels of control than identified in the draft report. However, pollutant generation methodologies were not available from the literature for these pollutants and thus could not be used on this nationwide study. Moreover, source control may be the most cost-effective way of controlling toxics.

5,6,7&8. Your comments on specific recommended rewordings of different sections of the report will be considered and required changes will be made in the final report.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Olson, USEPA Region II
Needs Survey Coordinator

NER North Carolina Department of Natural & Economic Resources
JAMES E. HOLSHOUSER, JR., GOVERNOR • GEORGE W. LITTLE, SECRETARY

DIVISION OF ENVIRONMENTAL MANAGEMENT
W. E. KNIGHT
Director
Box 27687, Raleigh 27611
Telephone 919 829-4740

November 29, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

Reference is made to the letter from Mr. John T. Rhett, Deputy Assistant Administrator for Water Program Operation, dated October 22, 1976, requesting review and comment on the draft report of the "1976 Survey of Needs for Control of Pollution From Combined Sewer Overflows and Stormwater Discharges". Our review was asked to focus principally on the base input data in Appendix B.

The data supplied for the eleven (11) urbanized areas selected for North Carolina appears to be adequate for the purpose of determining needs for the treatment of stormwater discharges and we, therefore, have no comments on the input data.

However, it is not clear if the needs in the urbanized areas, which show a percentage for the drainage area of the selected stream, is based only on the percentage of the urbanized area in the drainage area or if this particular stream and drainage area is used as a model to determine the needs of the total area. In any event, we recommend that the needs be shown for one-hundred percent of each of the selected urbanized areas.

If additional information is needed and we can be of assitance, please do not hesitate to contact us.

Sincerely,

W E Knight
W.E. Knight, Director

TAW:daw
cc: Mr. L.P. Benton, Jr.
Mr. C.M. Batten

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. W. E. Knight, Director
Division of Environmental Management
North Carolina Department of Natural
& Economic Resources
Post Office Box 27687
Raleigh, North Carolina 27611

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Knight:

Thank you for your letter of November 29, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your specific question on the percentage of drainage area for each selected stream, a particular stream and drainage area was used as a model to determine the level of treatment required for each urbanized area. After that determination, the cost for applying that treatment level to the entire urbanized area is determined. The cost estimates for each urbanized area within a state are then added to obtain the numbers printed in Tables 8-1 through 3 and 9-1 through 3 of the draft report.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Jim Kutzman, Region IV

North Dakota State

Environmental Control
DIVISION OF WATER SUPPLY
AND POLLUTION CONTROL

NORMAN L. PETERSON, P.E.
DIRECTOR
(701) 224-2354

JONATHAN B. WEISSBUCH, M.D.
STATE HEALTH OFFICER

W. VAN HEUVELEN, CHIEF
ENVIRONMENTAL CONTROL

Department of Health
Missouri Office Building
1200 Missouri Avenue
Bismarck, North Dakota 58505

November 30, 1976

Mr. James Chamblee
Chief, Needs Assessments Section
Facility Requirements Branch(WH-[illegible]7)
401 M Street SW
Washington, D.C.   20460

Dear Mr. Chamblee:

Mr. Rhett's letter of October 22, 1976, requested comments from this Department on the Draft 1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges. This Department feels a deep responsibility to comment on this draft although time and resources do not permit a complete check of all the references and methodology utilized in this study.

The 1974 Needs Survey for the State of North Dakota was prepared for this Department by a consultant in accordance with the guidelines presented by the Environmental Protection Agency. This was accomplished by direct contact with the communities involved in the Needs Survey. This Department feels that this is more reliable than the computer program modeling used in the 1976 Needs Survey for categories V and VI.

The needs for control of combined sewer overflows(Category V) for the State of North Dakota in the 1974 Needs Survey was shown as $50,000,000.00. At the present time, the needs for the cities of Fargo and Grand Forks for this category are in excess of $25,000,000.00. This does not include the needs for all of the other cities in the State of North Dakota with combined sewers. The 1976 draft indicates a range of needs from $344,000.00 to $399,000.00. In addition, this Department cannot agree with the figure of $686,000.00 which is indicated as needs met before 1976. The draft report indicated that for category V, the national needs are reduced to approximately 22% of the 1974 needs. However, the needs for the State of North Dakota have been reduced to approximately 0.8% of the 1974 needs in this category.

The needs for control of stormwater discharges(Category VI) for the State of North Dakota in the 1974 Needs Survey were shown as $344,000,000.00. The 1976 draft report indicates a maximum need of $410,000.00. The draft study indicates the national needs were reduced to approximately 14% of the 1974 needs. However, the needs for the State of North Dakota have been reduced to approximately 1.2% of the 1974 needs.

This Department objects to the methodology, best management practices, assumptions, projections, estimates of costs, and the complete report. It appears that a great deal of time, effort, and resources have been expended to obliterate the pollution control needs for categories V and VI. We do however, concur with Mr. Rhatt's statement in his letter of October 22, 1976, which reads as follows: "It was not intended to predict accurately the needs for any specific area." Therefore, this Department objects to the Draft 1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges.

Sincerely,

Raymond Rolshoven

Raymond Rolshoven, P.E.
Ass't Director

RR/tj
CC: Mr. John A. Green

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

31 JAN 1977

Mr. Raymond Rolshoven, P.E.
Assistant Director
North Dakota Department of Health
Missouri Office Building
1200 Missouri Avenue
Bismarck, North Dakota 58505

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Rolshoven:

Thank you for your letter of November 30, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The Needs Survey estimates for combined sewer and stormwater control were developed on a uniform nationwide basis to provide state-by-state needs estimates on a comparable basis. Several differences in the methodology of your 1976 Needs Survey and the USEPA 1976 Needs Survey provide an explanation for the significant differences in needs estimates for the State of North Dakota.

The 1976 Needs Estimate for Category V considers the capability of receiving waters to assimilate wastewater discharges from combined sewered overflows. This consideration generally leads to lower levels of required combined sewer control than those which were utilized in 1974. The 1976 Needs Estimates are based on treating all of a relatively small design storm and the first flush of all larger storms. This assumption leads to smaller treatment facilities than those generally identified in 1974.

Data available to us identifies 1,300 acres of combined sewered area in the Fargo urbanized area, and 800 combined sewered acres in other areas of the state.

We would appreciate receiving facilities plans or other documentation for the 25 million dollars of needs in Fargo and Grand Forks, if this information is available.

In regard to Category VI, the 1976 Needs Survey estimated the needs for control in urbanized areas of the nation. Regulations for the application of the NPDES permit program to separate storm sewered areas were published in the Federal Register of March 18, 1976. These regulations require an NPDES permit for separate storm sewers located in urbanized areas of the country. In North Dakota, using this assumption, the only area requiring control for Category VI is the Fargo urbanized area, consisting of 15.3 sq. miles. Although it is difficult to determine the area which was considered in Category VI of your 1974 Needs Survey, it apparently includes many smaller cities. Additionally, the 1976 Needs Survey included no needs for construction of new storm sewers.

North Dakota's final estimates after revisions to the draft report will be 4.306 million for Category V and 2.112 million for Category VI.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: William Hormberg, USEPA, Region VIII
Needs Survey Coordinator

RECEIVED
12 JAN 19[illegible]

North Dakota State

Environmental Control
DIVISION OF WATER SUPPLY
AND POLLUTION CONTROL

NORMAN L. PETERSON, P.E.
DIRECTOR
(701) 224-2354

JONATHAN B. WEISBUCH M.D.
STATE HEALTH OFFICER

W. VAN HEUVELEN, CHIEF
ENVIRONMENTAL CONTROL

Department of Health
Missouri Office Building
1200 Missouri Avenue
Bismarck, North Dakota 58505

January 6, 1977

Mr. James Chamblee
Chief
Needs Assessments Section
Facility Requirements Branch (WH-547)
401 M Street Southwest
Washington, DC 20460

Dear Mr. Chamblee:

This Department, in accordance with your memorandum of December 16, 1976, is enclosing a revised, independent estimate for Category V Needs for the State of North Dakota, as well as some general comments on the 1976 Needs Survey Category V and VI updating procedures.

The three levels of water quality used to determine Category V and VI Needs do not adequately address the water quality effects of combined sewer overflows and storm water discharges. Pollutants not considered, such as nitrogen, phosphorous, heavy metals and pesticides, will, in many cases, have a greater impact upon the use of a stream for water supply, recreation or wildlife, than the pollutants considered in developing these Needs estimates.

The cost estimating methodology used in this Survey is poorly defined and in some cases, contradictory. An example is the cost of storage, as illustrated below:

Capital Cost - Storm water detention basin = \$.50/gal.

Capital Cost - Combined sewer overflow for screening - swirl concentration

$$= 59{,}000 \ VR^{.598} + 43{,}200 \ VR^{.803}$$

Capital Cost - Combined sewer overflow for sedimentation

$$= 177{,}500 \ VR^{.598} + 193{,}900 \ VR^{.803}$$

Where VR = volume of runoff to be stored.

An example calculation for 1.0 MG gives the following costs:

Storm water detention:	\$500,000
CSO-Screening-Concentration	\$102,200
CS)-Sedimentation	\$371,400

It is difficult to understand how the cost of a basic storage facility can vary so much within one report where the methodology should be consistent.

The attached calculations were used to formulate a State estimate for Category V Needs using the same methodology as was used by EPA in developing their estimates. However, corrections were made in the assumptions and base data when errors were found.

The estimate submitted must be viewed as an absolute minimum need since it is based on the assumption that adequate treatment facilities exist to treat all combined sewer overflows once they have been collected and pumped to treatment facilities.

Due to a lack of time and the necessary data base, this Department was unable to provide an estimate for Category VI Needs. However, the $2.112 million dollars final EPA estimate is much too low to provide water quality control measures necessary for storm water discharges. The City of Fargo shows 33 direct discharges to the Red River, ranging in size from 15" to 66", as well as 77 discharges to the Red River, via county drains, ranging in size from 12" to 72". An inventory of storm water discharges in the City of Grand Forks shows 12 direct discharges to the Red River ranging in size from 10" to 54", as well as 25 discharges to two tributaries of the Red River, ranging in size from 8" to 60". This does not include private drains and other unreported drains. $2.112 million dollars is not an adequate amount of money to alleviate water quality problems from storm water discharges from these two communities, much less the entire State of North Dakota.

We hope that these comments will be given full consideration for inclusion in the February 10, 1977, report to Congress. If you should have any questions in regard to this Department's comments or Needs calculations, please feel free to contact our Office.

Sincerely,

Raymond R Rolshoven

Raymond Rolshoven, PE
Assistant Director

RR:dmb
Enc.
cc: EPA

HYDROLOGIC CALCULATIONS - FARGO, ND

No. of storms/yr. = 106

Average yearly rainfall = 18.73 inches

Mean rainfall/storm (MRF) = 18.73/106 = .177 inches

Design depth = 1.61 (MRF) = .284 inches

DESIGN CALCULATIONS - FARGO, ND

Population desnity of combined sewered areas (PDCS), from p. B-7

PCDS = 2,000/200 = 10.0 people/acre

% imperviousness (CSI)

CSI = $9.6(10.0)^{(.573\ -\ .0391 \mathrm{Log}_{10}\ 10.0)}$ = 32.82%

ROC = .15 + .75(.3282) = .40

Design volume of combined sewer treatment (DVCS):

DVCS = (.284)(.40)(410)*(.027158) = 1.26 MG

* The survey report indicates 200 acres served by combined sewers. The Fargo Facility Plan (Project No. C 380374) and communications with the City of Fargo indicate there are 410 acres served by combined sewers. Therefore, 410 acres is used for design calculations.

No. of storage facilities (NSP) = 2

Storage per facility (STCS) = 1.26/2 = .63 MG

Discharge rate from storage facility (TRCS)

TRCS = .63/(183**/106)
= .36 mgd

** Since rainfall occurs only in the period of April to September, the time between storms should be based on 183 days rather than 365 days for Fargo, or any other northern city.

Interceptor length (IL) = 2.8875(410) = 1,184 ft.

Because of the topography of the Red River Valley and the built-up nature of the area, 1,184 feet would not be adequate to transport flows to treatment facilities.

COST CALCULATIONS - FARGO, ND

Storage basins:

($.50/gal)(630,000 gal.)(.9091) = $286,400/basin

2 basins @$286,400 = $572,800 = Capital Cost

Capital Cost of pumping: $48{,}000(.36)^{.823}(.9091) = \$18{,}800\text{/station}$

O & M Cost = $2{,}500 + 1{,}930(.36)^{.468} + 60(.36) + 180(.36)$

= $3,800/yr./station

Total Capital Cost of pumping = 2($18,800) = $37,600

Total O & M Cost for pumping = 2($3,800) = $7,600/yr.

Cost of interceptor sewer = $(IL)(28.0\ TRCS^{.30})(\text{Cost Index})$

Interceptor cost = $1{,}184(28).36^{.30}(.9091)$

= $22,200

Total Category V Needs for Fargo, ND:

Detention basins = $572,800
Pumping = 37,600
Interceptor = 22,200
$632,600

O & M Costs = $11,500 + $7,600 = $19,100/yr.

Capital Cost/acre = $632,600/410 = $1,543/acre

O & M Cost/acre = $19,100/410 = $46.60/acre

The 1967 AWPA Report indicates 6,366 acres served by combined sewers in North Dakota. Since 1967, approximately 1,366 acres have been separated. This leaves a total combined sewered area of 5,000 acres. Basing the total State Needs on the cost/acre developed for the urbanized area, as was done in the Survey Report, the total Category V Needs for North Dakota are:

(5,000 acres)($1,543/acre) = $7,715,000 Capital Costs
(5,000 acres)($46.60/acre) = $233,000/yr. O & M Costs

Of these 5,000 acres of combined sewered areas, 410 acres are located in Fargo and 1,720 acres are located in Grand Forks. These are the two most highly urbanized areas in the State. The Category V Needs Estimate above assumes that in all communities, the combined sewer overflows can be treated by the existing waste treatment plants. Therefore, this cost must be viewed as a low estimate since expansion may be necessary at some plants.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

28 JAN 1977

Raymond Rolshoven, P.E.
Assistant Director
North Dakota Department of Health
Missouri Office Building
1200 Missouri Avenue
Bismark, North Dakota 58505

Re: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Rolshoven:

Thank you for your letter of January 6, 1977, offering additional comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

We have included the data presented in your design calculations for combined sewer areas: 410 acres for the urbanized area of Fargo, North Dakota, and 4590 acres for the non-urbanized areas of North Dakota. The resulting needs for North Dakota for Category V is $12.837 million and for Category VI is $2.032 million. Based on Mr. Philip Graham's conversation with Mr. Hormberg on January 21, 1977, I understand that you do not now wish to submit separate state needs estimates for Category V & VI.

Each of the pollutants, nitrogen, phosphorus, heavy metals and pesticides, was considered in the early stages of the needs survey development, but was rejected either because of a lack of a national data base or time and budget constraints on the project. Pollutant generation methodologies were not available from the literature for these pollutants. Moreover, "end-of-pipe" control may not be the most cost-effective way of controlling toxics.

You were correct in pointing out the variation in costs of storage. Both combined sewer overflow storage cost equations have been modified since the draft report. In addition, the combined sewer overflow cost equation for screening - swirl concentration was not accurately reported, although it was properly used in the computer program. Estimates of stormwater detention costs vary widely. The estimate of $0.50/gallon for stormwater detention is thought to be on the higher side. The consulting firms performing this needs survey were specifically requested to use cost equations based on available literature.

The final report, including all comments received from the states, will be forwarded to you early in February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section (WH-547)

cc: William Hornberg, USEPA, Region VIII
Needs Survey Coordinator

State of Ohio Environmental Protection Agency, Box 1049, 361 East Broad Street, Columbus, Ohio 43216 (614) 466-8565

December 28, 1976

RE: 1976 Needs Survey Catagories V and VI, Draft

CERTIFIED MAIL

OhioEPA

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
United States Environmental Protection
Agency
401 M Street, S.W.
Washington, D.C. 20460

James A. Rhodes
Governor
Ned E. Williams, P.E.
Director

Attention: Mr. Philip Graham

Dear Mr. Chamblee:

Attached is more detailed information on Catagories V and VI as discussed with Mr. Graham on or about November 28, 1976.

The comments and suggested changes should not be construed as criticism of the Consultants. I feel that, with the three month limit, the Consultants did a very good job. In the time allotted, they could not have covered the entire country in the detail that the "Survey" deserves.

The following are comments on some of the disagreements we have with the "Survey":

1. The three month, 5 year low flow does not relate to Ohio Water Quality Standards (WQS);
2. NPDES Permits are designed to require facilities that will produce an effluent which will meet WQS or BACTEA based on a seven day, 10 year low flow;
3. We feel that the 50,000 population cut-off is too high. The number of "Major" municipalities, as originally defined for the NPDES Permit Program was 10,000 or more population. Ohio has 155 cities with more than 10,000 population, 20 of these have populations over 50,000. Some of the remaining 135 are included in the Urban Areas covered by the "Survey". Many others are not, and are major problems, especially those located near the headwaters along the St. Lawerence-Ohio River Divide and other headwaters;

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4. A City in Ohio is defined as an incorporated entity having 5,000 or more population. We have 109 cities with 5,000 to 10,000 population that are problems as cited in 3, above; and,

5. Due to the above and the attachments that follow, we feel that U.S. EPA would be misleading Congress if the cost figures, as given in the "Draft Survey", are used.

There are two errors in the Tables on pages B-4 and B-5. On page B-4, last line, No. 160, Akron has 186 miles of Combined Sewers serving 13,000 acres, and 585 miles of Storm Sewers serving 21,560 acres. On page B-5, first line, No. 161, Canton has no (0.0) Combined Sewers, area served by Storm Sewers is not known.

We are not requesting an "independent state cost estimate" as mentioned in your memo to State and Regional Needs Coordinators, dated December 16, 1976.

We do request that the comments and suggestions contained in this letter and the Attachments be seriously considered in determining cost figures for Ohio.

I regret that, due to lack of time, I have not been able to submit a more detailed report. If you have any questions, please contact me at (614) 466-8945.

Happy New Year!

Yours very truly,

Tom Hagerty

L.T. Hagerty, P.E.
Director
1976 Needs Survey

Ned E. Williams, P.E.
Director
Ohio Environmental Protection Agency

LTH/NEW/jan
Enclosure

cc: Philip Graham
cc: Robert Holbrook
cc: Ernie Rotering
cc: Ted Horn, Region V
cc: Ronald L. Wycoff
cc: Jim Greener

ATTACHMENTS

Summary, Maps and Comments concerning the "Draft 1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges".

	Page
Attachment 1 - A. Summary	1
B. Urban Areas	1 & 2
Attachment 2A - State Map	4
2B - Urban Area Maps	5 - 13
Attachment 3 - Comments and Suggested Changes	14 - 16

ATTACHMENT NUMBER I

Summary

A. It is our understanding that the purpose of the Needs Survey, Catagories V and VI, was to determine the impact of Combined Sewer Overflows (CSO) and Storm Sewer Discharges (SSD) on streams in and below Urban Areas. If this determination is to be made properly, it is necessary to gage the low flow in the stream(s) up stream of the Urban Area(s). When this is done, CSO's and SSD's for various rainfalls can be plugged into an equation, the WWTP effluent added and the net effect on the stream evaluated.

The above procedure is relatively simple if the Water Supply for an Urban Area is taken from a large river, a natural lake or from wells. However, if the Water Supply is taken from an impounded stream or a stream that is pumped for Off Stream Storage, the problem becomes more difficult. The Gaging Station(s) must be downstream of the impoundment(s) and upstream of any CSO's and SSD's in order to obtain correct data.

The following tabulations of Water Supplies includes the 17 Urban Areas, plus Cities (>5,000 population) and Villages, in Ohio:

	Number	Description
1.	76	Impounded Stream
2.	23	Off-Stream Storage*
3.	16	Ground** and On-Stream***
4.	8	Ground and Off-Stream
5.	18	On-Stream and Off-Stream
6.	6	Ground and "On" and "Off" Stream

*Pumped to Upground Reservoirs
**Well Supplies
***Impounded Stream

B. Urban Area - Controlled Streams

None of the ten "study" cities cited in the "Draft 1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Storm Water Discharges," including any areas tributary to Controlled Rivers.

Ohio has many controlled streams. Those areas included in the seventeen areas, covered in the "Draft" are: Akron; Columbus; Lima; and Youngstown.

Akron has reservoirs on the Cuyahoga River which impound water during wet weather and release it for water supply during dry weather. Ravenna has a similar operation on a tributary to the Cuyahoga River.

Columbus has reservoirs on the Scioto River, Big Walnut Creek and Alum Creek. The Scioto River and Big Walnut reservoirs are controlled for water supply only. The Delaware reservoir on the Olentangy River is used for Flood Control only with a guarantted dry weather flow of five to forty cfs. The Alum Creek reservoir is a combination water supply and flood control facility for the cities of Westerville and Columbus. This is a new reservoir. At present we do not know the plan of operation. Water used by Westerville is discharged to the Columbus Sewer System.

Lima pumps water from the Ottowa River to upground storage reservoirs during high flows. The flow in the River, below Lima, during dry weather is essentially all sewage plant and industrial waste discharges.

Youngstown and other cities are located on the Mahoning River or its tributaries. Mosquito Creek and Meander Creek reservoirs are used for Warren and Youngstown - Niles respectively. Milton, West Fork and Berlin reservoirs were designed and are used for low flow augmentation during summer months. Their main purpose is to supply enough water to lower the high temperatures due to steel mill discharges to the Mahoning River. As a result, low Dissolved Oxygen problems, in the River, have been experienced in the months of November, March and April while the reservoirs are being filled.

ATTACHMENT NUMBER 3

NO.	Urban Area	Attachment #2 Map No.	USGS Station No.	Data Code (7-6) Present	Data Code (7-6) Proposed	Comments	Evaluation of Gage Station
1.	Akron	37-59	2060	2	4	This Gaging Station is downstream of all combined sewer overflows and storm water discharges. Stations should reflect flow from Lake Rockwell and Little Cuyahoga River.	1. Not Good
2.	Canton	37-59	1185	2	3	Flow in the Nimishillen Creek above Canton WWTP is from Industrial discharges and Louisville WWTP effluent. Canton WWTP should be subtracted.	2. Not Good
3.	Cincinnati	37-62	N/A*	5	6	Markland Dam is miles below the Cincinnati U.A. All discharges, Municipal and Industrial, from Ohio and Kentucky and stream flows should be subtracted from the Markland readings.	3. Not Good
4.	Cleveland	37-60	N/A*	8	8	Major WWTP's with combined sewer systems shown. (See maps 4 and 4.a)	4. Cleveland Southerly & Bedford are not direct t to Lake Erie
5.	Columbus	37-63	2275	3	6	Plant effluent discharges to a river pool. The Gaging Station, in this pool, is upstream of the effluent and is greatly influenced by the effluent. The extent of the influence is dependent on wind direction. Gage also records all combined sewer and storm discharges in the U.A.	5. Not Good
6.	Dayton	37-64	2695	3	4	Gage Stations should be on the three Rivers and Wolf Creek to cover flows to the Urban Area.	6. Not Good
7.	Hamilton	37-62	2740	3	4	Flow above this station is controlled by storing River Flow in the Canal and discharging through the City Hydroelectric Plant.	7. Questionable

Attachment No. 3

NO.	Urban Area	Attachment #2 Map No.	USGS Station No.	Data Code (7-6) Present	Data Code (7-6) Proposed	Comments	Evaluation of Gage Station
8.	Huntington-Ironton, Ohio	N/A	N/A	5	6	Gaging Station is below Huntington effluent and above Ironton effluent. Reading appears to be too high, 44,000 cfs, at this station with only 36,000 cfs at Markland Dam. ORSANCO thinks 24,000 cfs would be more nearly correct. Kentucky Office of USGS told me that no flows below 50,000 cfs have been recorded since 1968.	8. Questionable
9.	Lima	37-62	1875	1	6	This Gaging Station is downstream of the Lima WWTP effluent plus three Industrial Waste discharges. These discharges plus dry weather storm flows are all of the low flow. Higher flows in the Ottawa River are impounded and used for water supply for the City. Low flow above Lima occurs when the River is too low to pump to storage. The Ottawa River is the west stream as corrected on map.	9. Not Good
10.	Lorain-Elyria	37-65	N/A	8	8	Lorain discharges to Lake Erie, 0 cfs. Elyria Station 042005.	10. Lorain, L.E. Elyria 2005;
11.	Mansfield	37-65	1305	1	1	Probably USGS Station 1305, Touby Run is the same as Rocky Fork Creek.	11. O.K.
12.	Springfield	37-65	2695	2	3	WWTP effluent and combined sewer and storm water discharges should be subtracted.	12. Not Good
13.	Steubenville	37-65	N/A	5	6	Gaging Station is above the mouths of the Beaver and Little Beaver Rivers. May be low.	13. Not Good
14.	Toledo	37-66	N/A	8	8	WWTP discharges to Maumee Bay, which is difficult to distinguish from Lake Erie. It does not discharge to the Maumee River. Cfs should be 0.	14. Should be 0 cfs
15.	Wheeling-Belmont County, Ohio	N/A	N/A	5	6	Same Gaging Station as Steubenville (See 13). Belmont County S.A. No. 1 currently serves Martins Ferry, Bridgeport and Bellaire. In the near future the Authority will serve the County Sewer District No. 1. Tributary population will increase by 3,000 to 4,000.	15. Questionable

Attachment No. 3

NO.	Urban Area	Attachment #2 Map No.	USGS Station No.	Data Code (7-6)		Comments	Evaluation of Gage Station
				Present	Proposed		
16.	Youngstown	37-66	0980	3	6	Gaging Station is just upstream of the Youngstown WWTP. The Warren, Niles, McDonald, Girard and the Trumbull County Mosquito Creek Treatment Plants plust many Industries (mainly steel mills) are upstream of this station. Probably station 040940 should be used.	16. Should be 0940
17.	Parkersburg-Marietta, Ohio	N/A	N/A	5	6	Point Pleasant Gaging Station is about 60 to 70 river miles downstream from Parkersburg. It is possible that the intended Station was at Willow Island Dam in Pleasant Township, W.V. This station is 15 to 20 miles upstream from Parkersburg. 44,000 cfs is to high for either of these stations. (See #8)	17. Questionable

*N/A means not available in our office for Ohio River Urban Areas and not applicable in the Cleveland Urban Area.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

2 C JAN 1977

Mr. Ned E. Williams, P.E.
Director
Ohio Environmental Protection Agency
Box 1049
361 East Broad Street
Columbus, Ohio 43216

RE: Draft Report on 1976 Needs Survey for Combined Sewer Overflows and Stormwater

Dear Mr. Williams:

Thank you for your letter of December 28, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The water quality criteria identified in the draft report were for wet weather conditions. Existing standards are mainly written for dry weather flow conditions and, therefore, are based on a 7-day, 10-year low flow. It is our feeling that wet weather conditions normally require different water quality criteria and receiving water flow constraints. Additionally, nationwide wet weather criteria were required for consistency throughout the assessment.

Your comments requesting inclusion of communities other than urbanized areas for stormwater control needs was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

The regulations defined the term "separate storm sewer" as "a conveyance or a system of conveyances .... located in an urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

Thank you for your specific input on combined sewered areas and receiving water classifications for Ohio. All of your recommended changes were made in our final computer run-off on Jan 21, 1977. The 1990 Category V Needs for Ohio were increased to $1765.612 million. The 1990 Category VI Needs for Ohio are $4752.180 million.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ted Horn, US EPA Region V
Needs Survey Coordinator

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES
POST OFFICE BOX 2063
HARRISBURG, PENNSYLVANIA 17120

December 3, 1976

In reply refer to:
16-4.111
4-3.8

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
U. S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

Re: Sewerage, 1976 Municipal Needs Survey

Dear Mr. Chamblee:

Pursuant to Mr. Rhett's letter of October 22, 1976, we are taking this opportunity to submit comments and recommendations concerning the preliminary results of the 1976 Municipal Needs Survey for Categories V and VI.

We realize that previous Category V and Category VI needs estimates which were compiled by the individual states in 1974 suffered from lack of uniform guidelines and methodologies, and we would like to commend EPA in its attempts to rectify this situation. As with the survey for Categories I-IVa, the use of an impartial, outside contractor should prove worthwhile.

In view of the following comments and observations, we would urge you to reevaluate the underlying assumptions and methodologies used in 1976 in order to avoid what may be a severe underestimate of needs in both categories for the nation as a whole.

A. General Observations

1. It appears that the survey methodology follows a logical pattern and utilizes reasonable assumptions regarding factors such as pollutant removal efficiencies for various control or treatment schemes, and minimum degrees of treatment required for the three basic levels of receiving water quality to be protected. We must, however, question several of the other basic assumptions concerning design precipitation

magnitudes, runoff coefficients, drainage areas, and mathematical models chosen for this survey since the estimated 1976 needs, both for the nation and for Pennsylvania, have been seriously reduced from the 1974 estimates.

For example, a tabular summary of Pennsylvania's 1973, 1974 and 1976 Needs Survey results for Categories V and VI is presented as follows:

Year	Category V	Category VI
1973	* $1,589,000,000 (12.51%)	(This information not included in the 1973 survey.)
1974	* $2,439,000,000 (7.85%)	*$3,743,000,000 (1.59%)
1976	** $ 217,315,000 (3.22%)	**$ 582,906,000 (1.73%)

*July, 1973 Dollars
**January, 1976 Dollars
Number in parentheses indicates percent of national totals

If the applicable inflation factor (1.41) is used to convert July, 1973 dollars to January, 1976 dollars, it is obvious that the 1976 Needs Survey has resulted in a 16-fold decrease in Category V needs and a 9-fold decrease in Category VI needs from those needs reported during the 1974 Needs Survey. We cannot, however, accept the implication that our previous needs estimates were so far off the mark.

2. A review of Appendix B indicates that the survey concentrated upon the needs for Pennsylvania's 13 SMSA areas and one additional urban area (Williamsport). We would agree that the majority of the Category V and Category VI needs occur in these major urban areas, and this was our basic approach for estimating the Category VI needs during the 1974 Needs Survey. Enclosed is a copy of the broad rationale and the methodology which we used for Category VI at that time.

As far as Category V is concerned, in 1974 we reported the total needs which were identified for 29 authority/facilities (representing 26 authorities). The methodologies used to estimate these needs varied from case to case.

3. From a review of Sections 8.4 and 9.2 of this report, "relatively small design storms" were used as part of the survey methodology to determine Category V and Category VI needs. We understood from a recent telephone conversation with you that a "relatively small design storm" consists of 80% of the applicable five-year storm for a particular

urban area. Actually, as indicated on pages 4-10, the average rainfall which occurs 80% of the time was used for this survey. As the enclosed consultant's comments state, this would account for some of the differences in reported needs. You also indicated that the total needs for Categories V and VI were estimated on the basis of having to meet the highest of the three basic levels of water quality criteria which are listed in Tables 21 through 23.

Although it is not specifically shown in the attached methodology for the 1974 Category VI estimates, we used an average rainfall intensity ranging from 0.9 to 1.2 inches per hour. (This is roughly a two-year storm of one-hour duration.) We then calculated the average runoff using the Rational formula, $Q = CAi$, using an average runoff coefficient of 0.5 for all urban areas. We then used 10% of the calculated runoff in each case to size the storm water storage and treatment facilities and to estimate their costs. Granted, the use of the Rational method has its limitations; however, from this brief discussion, it would appear that we were more conservative in our approach during 1974 for Category VI than the contractor was in 1976, yet the 1976 results do not support this assumption.

4. Finally, to the best of our knowledge, this Department was not consulted at any point before or during the Category V and Category VI survey to discuss general study procedures and assumptions to be used. Although we understand the need for a uniform nationwide methodology, we fail to understand the need for a complete lack of communication regarding this portion of the 1976 Municipal Needs Survey.

B. Specific Comments

1. Page 2-2, Section 2.1.1, next to the last paragraph - Although this would have no apparent bearing on the outcome of the survey, there are some erroneous statements included here.

According to the U.S.P.H.S. 1962 Drinking Water Standards, a water supply source containing more than 500 mg/l total dissolved solids should generally not be used when other more acceptable sources are available (i.e., it is not an absolute limit). Also, there is no maximum turbidity limit for raw water supplies in the U.S.P.H.S. 1962 Standards. A limit of five turbidity units (not mg/l) would apply to finished waters served to the public. EPA has promulgated interim primary drinking water standards which closely parallel to the Public Health Service Standards and we suggest that you coordinate this portion of the survey report with EPA's Water Supply Program staff.

2. Section 3 - In order to further assist our own program efforts in the area of treatment and/or control of combined sewer overflows and storm water, we would appreciate your sending us copies of references 6-8 and 10 which were indicated in Part I of the Survey Report, if possible.

3. Section 7, Table 7.1, pages 7-21 - We would be extremely interested to know what specific treatment and/or control combinations were chosen for the 14 urban areas identified for Pennsylvania in Appendix B. We feel that this will shed some light on the reasons for the decreases in the reported needs for Categories V and VI from the 1974 results. This type of information, as well as information on design storms, rainfall intensities, runoff coefficients, etc., should be included in tabular form for each area in this Survey Report.

C. Other Comments

In conjunction with our on-going Comprehensive Water Quality Management Program (COWAMP), we requested one of our COWAMP consultants to review this report. These comments are enclosed.

Sincerely yours,

Brij M. Garg

Brij M. Garg, Chief
Facilities Section
Division of Water Supply and Sewerage
Bueau of Water Quality Management

Enclosure

CBE

CHESTER-BETZ ENGINEERS
One Plymouth Meeting Mall Plymouth Meeting, Pa. 19462
Suite 413 Telephone: 215 828-0400

CBE Memo No. 303

TO:
Mr. F. Rab
Dept. of Environmental Resources
Fulton Bank Bldg.
3rd & Locust Sts.
Harrisburg, PA 17101

Mr. Tom Walton
Delaware Valley Regional Planning Commission
Penn Towers Building
1819 J.F.K. Boulevard
Philadelphia, PA 19103

FROM: T. May TMay

Cc: K. O'Day
W. Bellaman

SUBJECT: REVIEW OF EPA REPORT ON COMBINED AND STORM SEWER SURVEY OF NEEDS

DATE: November 29, 1976

I have reviewed the 1976 Survey of Need for control of pollution and combined sewer overflows in storm water discharges (draft October 1976). The following summarizes my comments on the report. I have forwarded the report to Wayne Bellaman of TCE and he will probably also be commenting in the near future.

1. The approach described in the Need Survey appears reasonable. The assumption of an 80 percent storm as the design storm, consideration of assimilative capacity, consistent definition of urban area, etc. are all in the right direction.

2. The approach is based on many assumptions but this is probably necessary due to the scope of the undertaking.

3. The assimilative capacity assumptions presented in the report are especially crude; however, these crude assumptions are probably better than no consideration of the assimilative capacity that was used in previous Needs Surveys.

4. Taken in total, I believe the Needs survey is reasonable and is especially welcome in comparison to what it replaces (ie., much better than the techniques used in previous surveys).

5. The description of the Philadelphia case study (p. 5-5) is very interesting. The report concludes that water quality standards will not be met even after all points source allocations are complied with. The report also indicates that approximately an 80% reduction in non-point source and combined sewer loads will be required in order for the Delaware to meet water quality standards. It will be interesting to see if these conclusions are verified during our COWAMP/208 work.

6. The analysis of design storm selection (p. 4-10) was very interesting. The report showed that previous surveys may have used a design storm of, say, a 5-year, 24-hour storm. This type of storm would deliver approximately 5" of rain. It can be shown that this rainfall is in the 99.83 percentile. The October 1976 draft assumes an 80 percent storm rather than a 5-year 24-hour storm. This 80 percent storm turns out to be .74" or only 15% of the 5-year value. Assuming that storm water and combined sewer costs are a function of the volume of storm water, it is obvious that assuming an 80 percent storm will drastically reduce the cost for storm water/combined sewer overall treatment.

/11

(1974 NEEDS SURVEY)

COMMONWEALTH OF PENNSYLVANIA

Special Report on Assessment of Needs of Category VI: Treatment and/or Control of Storm Water

The needs for this category have been developed on a state-wide basis approach.

(1) Broad rationale: Based upon the information available in the Department only those areas of the state were selected for assessing needs of Category VI which are known to have significant water quality problems as a result of storm water discharges into the surface waters. Most of the areas considered are the Standard Metropolitan Statistical Areas (SMSA) and areas which are adjacent thereto.

Most of these population concentration areas have combined and/or separate sewer systems. The financial needs for separating the combined sewer systems have already been considered under Category V. The needs assessed in Category VI are for:

(i) new storm sewers which are considered necessary to abate water pollution. It should be emphasized that no new storm sewers which are for flood control functions, and for the treatment of wastes from non-point sources, or from non-publicly owned sources are included in this assessment.

(ii) storage and treatment facilities. The treatment facilities are expected to provide the level of treatment which is necessary to meet the established water quality standards for the waters of the Commonwealth.

(2) Methodology: It is known that in the areas included in this survey for Category VI, the majority of them either have storm sewers or have combined sewer systems. Therefore, it is estimated that only 10% of total storm water volumes would need to be conveyed by new storm sewers to serve year 1990 population.

For calculating the cost of facilities to control and treat storm waters, it is estimated that only 10% of the total runoff would need to be treated because of high pollution load. This 10% would essentially be the flow resulting from first flush. The remainder 90% of the storm flow will either be carried by combined sewer systems or would not have high pollution load to justify storage and treatment.

(3) Total State-wide cost assessment for Category VI: As a result of systematic analysis based on reasonable assumptions, it is estimated that an estimate of eligible cost for Category VI is 3.743 billion dollars.

(4) Sub-area and/or Authority costs for Category VI:

Name of SMSA or Municipality	Total Area to be served Sq. Miles	Total Storm Runoff MGD	New Storm Sewers To Carry MGD	*Elig. Cost Billion $	Storage and Treatment Facilities for MGD	**Elig. Cost Billion $
Philadelphia SMSA	1000	249,000	24,900	0.210	24,900	1.610
Pittsburgh SMSA	528	98,000	9,800	0.112	9,800	0.640
Allentown-Bethlehem-Easton SMSA	112	25,600	2,560	0.024	2,560	0.166
Johnstown SMSA	36	7,460	746	0.008	746	0.048
Erie SMSA	40	7,450	745	0.008	745	0.048
Harrisburg SMSA	150	34,200	3,420	0.032	3,420	0.222
Altoona SMSA	22.5	4,660	466	0.005	466	0.030
Lancaster SMSA	45	10,210	1,021	0.010	1,021	0.066
Reading SMSA	40	9,120	912	0.009	912	0.059
Scranton SMSA	90	18,650	1,865	0.019	1,865	0.121
Wilkes-Barre SMSA	68	14,100	1,410	0.014	1,410	0.092
York SMSA	39	8,900	890	0.008	890	0.058
Williamsport (Lycoming)	9.5	2,000	490	0.0049	200	0.013
Hazleton (Luzerne)	5.85	1,210	500	0.0051	121	0.0078
Honesdale (Wayne)	4.2	870	705	0.0072	87	0.0057
Wellsboro (Tioga)	4.0	830	250	0.0025	83	0.0053
Monongahela (Washington)	1.8	375	210	0.0021	38	0.0025
Jeannette Area (Westmoreland)	36.0	7,460	1,720	0.0175	746	0.0485
			SUB-TOTAL	0.499		3.244

TOTAL ESTIMATED ELIGIBLE NEEDS FOR CATEGORY VI - $3,743,000,000

* Average size of new storm sewer 24" dia. costing $40 per lineal foot

** Storage cost estimated @5¢ per gallon
Treatment cost estimated @1.5¢/gallon } Per EPA publication, "Urban Stormwater Management and Technology: An Assessmen of May 1974

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

26 JAN 1977

Mr. Brij M. Garg, Chief
Facilities Section
Division of Water Supply and Sewerage
Bureau of Water Quality Management
Pennsylvania Department of Environmental
Resources
Post Office Box 2063
Harrisburg, Pennsylvania 17120

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Garg:

Thank you for your letters of December 3, 1976 and January 3, 1977, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your first general observation, several methodology changes have been made for the final report. These changes include: (1) increasing the design storm for combined sewer control to the 90th percentile storm for the aesthetics and fish and wildlife criteria and the 98th percentile storm for the recreation criteria, (2) several changes to the cost functions, and (3) a keypunch error correction in the stream classification for Philadelphia from 11 to 12.

These changes increase the needs results for the State of Pennsylvania to $820,505,000 (4.516 percent) for Category V and $3,097,523,000 (5.874 percent) for Category VI. Although these needs are lower than those reported in 1974, it is our opinion that they provide a consistent basis of comparison for relative needs among the states. Upon completion of ongoing 208 studies and other storm water studies, a more specific data base will be available for estimation of needs in the future.

The design storm utilized in the needs assessment, as mentioned above, was the 80th percentile storm for Category VI and the 90th or 98th percentile storm for Category V. This is a smaller storm than was utilized by most states in the 1974 needs assessment and is a significant reason for the reduced total national needs estimate. Our opinion is that this conservative approach will provide the most cost effective blend of pollutant capture for all storm sizes while it is likely to meet the wet weather water quality criteria identified.

In regard to your general comment on communications between EPA and the states relating to the Categories V & VI, we have utilized every possible method of developing state input within the time and budget constraints placed on the project. An early draft report was submitted for your comments on the methodology and the resulting cost estimates. The report was explained in detail at a meeting in Philadelphia on November 17, 1976. We regret that more time was not available for your review and comment.

In regard to your specific comments on solids criteria for water supplies, the material listed in the draft report was summarized from "Quality Criteria for Water" published by EPA in July, 1976. There appear to be some discrepancies between this document and the EPA interim primary drinking water standards. These discrepancies will be clarified in the final report.

References 6 and 10 are published and are available from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22161. References 7 and 8 are draft reports to the EPA Research and Development Group and will be available within several months. Your name can be placed on the mailing list for these latter two references by contacting Mr. Richard Field, Chief Storm & Combined Sewer Overflow Branch, U.S. Environmental Protection Agency, Edison, New Jersey 08817 (Telephone 201-548-3347).

Information such as specific design storms, runoff coefficients and other intermediate results from the computer documentation was not included in the draft report to keep it as concise as possible. These numbers are available and can be provided upon specific request.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. T. May,
Chester-Betz Engineers
One Plymouth Meeting Mall
Suite 413
Plymouth Meeting, Pennsylvania 19462

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. May:

Thank you for your letter of November 29, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

As you know well, the approach of the 1976 Needs Survey was to provide a reasonable and consistent needs estimate for these two categories based on the minimal amount of information available. The on-going 208 Studies and other studies, such as the COWAMP/208 work, will provide more specific data for estimation of needs in the future.

The final report, including all comments received, will be forwarded to the states in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

E. KENNETH AYCOCK, M.D., M.P.H., COMMISSIONER
J. MARION SIMS BUILDING — 2600 BULL STREET
COLUMBIA, SOUTH CAROLINA 29201

November 9, 1976

Mr. John T. Rhett
Deputy Assistant Administrator for
Water Programs Operations (WH-546)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Re: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Rhett:

The South Carolina Department of Health and Environmental Control is in receipt of your letter of October 22, 1976, concerning the draft report on the 1976 Survey of Needs for Control of Pollution From Combined Sewer Overflows and Stormwater Discharges. The staff of this Department has reviewed the draft report, and it's proposed methodology, and offers the following comments for your review.

1. Section 2.1 of the text indicates that the stormwater pollutants selected for control and to be utilized as a measure, include suspended solids, dissolved oxygen and fecal coliform. This Department does not agree that control of these few pollutant constituents will be sufficient to achieve the desired water quality goals in the State of South Carolina. If feasible, therefore, we suggest that pollutants selected for control include, in addition to those identified in the report, BOD, total-P, TKN, NO_2 and pH. We feel that the addition of these control factors would help identify potential nutrient and organic loading problems in receiving streams, thus making the survey a more accurate reflection of the needs of this State and of the Nation.

2. We suggest that alternative disinfection techniques to chlorination should be considered (i.e., ozone, bromine chloride, dechlorination, etc.) due to the adverse effects of residual chlorine upon the aquatic ecosystem.

3. Section 4.11 of the draft report indicates that the treatment of stormwater and/or combined sewer discharges will not be required if the DO level in the receiving stream is 5.0 mg/l or greater. We do not feel that this statement is accurate. Rather, we suggest that the teatment of stormwaters should not be discounted unless water quality impact analysis (modelling) indicates that the resultant pollutant loading will not be sufficient to depress instream DO below acceptable levels.

---

4. The NEMUR General Composition Schematic (Figure 7.1) is not clear in its present format. The utilization of flow directors and/or other clarifying remarks would facilitate model review.

5. The methodology utilized for determining a State's Category VI needs is too restrictive. For example, in South Carolina, the technique of basing stormwater runoff needs upon urban areas of 50,000 plus population will totally discount such critical (or potential) problems areas as the Myrtle Beach (Grand Strand) area, already involved in an Environmental Impact Statement and the Beaufort area (a potential problem area). We would suggest that EPA require the contractor to contact each State to determine if there are any such problem areas of less than 50,000 population, that should be surveyed. This procedure would probably lead to a more accurate survey and report on Category VI needs.

This Department would like to express our appreciation to the Environmental Protection Agency for the opportunity to review and comment on the draft report. A representative of this Department will attend the meeting with EPA and the contractors in Atlanta, on November 15, 1976, to further voice and discuss our comments and suggestions on the draft report.

Very truly yours,

James G. Zack, Jr.
Manager, Budgets and Grants
Administration Section

cc: Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Mr. James Dutzman, Director
Needs Survey
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30308

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

16 NOV 1976

Mr. James G. Zack, Jr., Manager
Budgets and Grants Administration Section
Environmental Quality Control
South Carolina Department of Health and
Environmental Control
2600 Bull Street
Columbia, SC 29201

Dear Mr. Zack:

Thank you for your comments on our draft report on needs for combined sewer overflow and stormwater control (Categories V and VI).

Your comments are being studied carefully and will be taken into consideration in our final report to the Congress.

We are sorry that we cannot yet comment on the issues your letter raised. These are under study, along with comments from other states and territories.

As soon as possible, a complete explanation of our final cost estimates will be forwarded.

Sincerely,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

BC&E

BLACK, CROW & EIDSNESS, INC.
CONSULTING ENGINEERS

PRINCIPAL OFFICE: 7201 N. W. ELEVENTH PLACE, GAINESVILLE, FLORIDA
REGIONAL OFFICES: ATLANTA, GEORGIA / CLEARWATER, FLORIDA
BIRMINGHAM, ALABAMA / BOCA RATON, FLORIDA / NAPLES, FLORIDA
SAN JOSE, COSTA RICA / PHILADELPHIA, PENNSYLVANIA / MONTGOMERY, ALABAMA

PLEASE REPLY TO:
GAINESVILLE, FLORIDA 32602
POST OFFICE BOX 1647
7201 N. W. ELEVENTH PLACE
904/377-2442
CABLE ADDRESS: BCEGNVFLA

November 29, 1976

Mr. James G. Zack, Jr.
South Carolina Department of
Health and Environemntal Control
2600 Bull Street
Columbia, South Carolina 29201

Re: 1976 Survey of Needs for
Control of Pollution from
Combined Sewer Overflow and
Stormwater Discharge
Project No. 573-7600-4

Dear Mr. Zack:

On Monday, November 15, 1976, you attended a meeting at EPA Regional Offices in Atlanta concerning review of the draft Categories V and VI, 1976 Needs Survey. At that time you expressed an interest in receiving a copy of the notes prepared for the site study portion of our presentation. Enclosed for your information is one copy of the above notes.

If you have any further questions, or need additional information regarding the site studies or design storm criteria, please let me know.

Very truly yours,

BLACK, CROW AND EIDSNESS, INC.

Ronald L. Wycoff

Ronald L. Wycoff, P.E.

RLW/mfl

Enclosure

xc: Mr. R. D. G. Pyne
Mr. Philip Graham

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

11 JAN 1977

Mr. James G. Zack, Jr.
Manager, Budget and Grants
Administration Section
South Carolina Department of
Health and Environmental Control
J. Marion Sims Building
260 Bull Street
Columbia, South Carolina 29201

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater Control

Dear Mr. Zack:

Thank you for your letter of November 9, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V and VI).

In regard to your specific comment on inclusion of other pollutants in the determination of control levels, we would agree that in specific cases other pollutants such as toxic materials and nutrients may control the treatment level required to meet receiving streams standards. However, pollutant generation methodologies were not available on a nationwide basis such that inclusion of the required control for these pollutants could be accomplished within the time and budget restraints of the project. As more specific information is developed through the 208 planning program and other sources, a more detailed methodology for the Category VI needs estimation methodology can be developed for future needs surveys.

The draft report does not recommend a nationwide program of chlorination, but merely uses published cost estimated equations for cholrination to develop a cost estimate for disinfection. Where receiving water conditions dictate, alternative disinfection techniques to chlorination should be considered for each individual case.

The water quality impact analysis conducted in the needs survey for the ten specific site studies was utilized to indicate where combined sewer and stormwater pollutant loading would be sufficient to depress instream D.O. levels below the identified wet weather criteria. The D.O. level of 5.0 mg/l was identified as an acceptable wet weather water quality level for this nationwide study. In areas where receiving water standards are higher than this level, the resulting treatment levels for stormwater may be in excess of those evaluated in the draft report.

The NEMUR general computational schematic (Figure 7.1) is only a simplified presentation of the "building blocks" for the computation model. The exact computational steps are described in Sections 7.5 through 7.11.

Your specific comment requesting inclusion of non-urbanized areas for stormwater control needs was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

In the regulations, the term "separate storm sewer" is defined as "A conveyance or system of conveyances...located in an urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff". The permit issuing authority may designate other storm sewers as being significant contributors of pollutants and, thus, subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

The final report, including all comments received from the states, will be forwarded to you in early February 1977.

I hope that this has answered your questions, and if I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Jim Kutzman, USEPA Region IV
Needs Survey Coordinator

12/14

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
NASHVILLE 37219

RAY BLANTON
GOVERNOR

Eugene W. Fowinkle, M.D., M.P.H.
Commissioner

621 Cordell Hull Building

November 30, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 Main Street, S.W.
Washington, D.C.

Re: Category V and VI
1976 Needs Survey

Dear Mr. Chamblee:

This is written in reply to Mr. Rhett's letter to Mr. Church dated October 22, 1976.

In general the Category V and VI Study for 1976 appears well done and is in a form that will be useful in future stormwater treatment studies. I agree that methods for computing treatment requirements should be standardized. The referenced study can be the basis for this standardization and formulates data in a manner that is readily understood.

I would differ with the study on one or two aspects. In the "Survey of Needs for Treatment and/or Control of Stormwaters in Tennessee" prepared for Tennessee in 1974 by Consoer, Townsend and Associates, interceptor lines, storage facilities and treatment facilities were plotted on maps. I believe this gave a more accurate, yet not too complicated, method for figuring lengths of interceptors than the empirical approach proposed in the present study on page 7-27.

The present study includes only 6 urban areas in Tennessee. The Consoer-Townsend Study selected 78 urban areas all of which were located on water quality limited stream segments.

I agree generally with the differences in the 1974 study and the 1976 study as stated on page 9-5, but do not agree that the definition of urbanized areas should have been as restrictive as it was in the current study, resulting in Tennessee's statement of needs being cut from 4.207 billion to 0.467 billion. As a minimum, the study should include urban areas having a population of 10,000 or more. Otherwise states with few or no urban centers having 50,000 population or greater are severely penalized and their needs are not fairly represented.

Thank you for the opportunity to comment on the study. In preparing for the 1978 Needs Survey, I offer the following suggestions:

1. Begin preparation now and get information to the States well in advance of the Survey.
2. Return control of the Survey to the States, with appropriate guidelines to insure uniform data collection.
3. Allow the States to comment on proposed guidelines, boundary conditions, assumptions and preliminary data well in advance of the Survey, commencing in early calendar year 1977.

Sincerely,

Quentin C. LaPrad, P.E.
State Director
1976 Needs Survey

QCL/slh 2-3

cc: Mr. J. L. Church, Jr.
Mr. Jim Kutzman
Mr. Ellis Cokes

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

18 JAN 1977

Mr. Quetin C. Laprad, P.E.
State Director, 1976 Needs Survey
Tennessee Department of Public Health
621 Cordell Hull Building
Nashville, Tennessee 37219

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. LaPrad:

Thank you for your letter of November 30, 1976, offering comments on our draft report which estimated needs for combined sewer overflow and stormwater control (Categories V & VI).

Your proposed alternate methodology for defining interceptor lines, storage facilities, and treatment facilities by plotting these locations on maps was beyond the time and budget constraints allowable on the 1976 Needs Survey for these categories. Upon completion of the ongoing 208 studies and other storm water evaluations, a more detailed data base may be available for use in the future.

Your comments requesting inclusion of non-urbanized areas for storm water control needs was voiced by several states, although not all discussed the specific population floor of 10,000 or more. Regulations for the application of the NPDES program to separate storm sewer were published in the Federal Register of March 18, 1976. This document was utilized to determine the areas requiring needs in Category VI.

In the regulations the term "separate storm sewer" is defined as "A conveyance or system of conveyances....located in a urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census-designated urbanized areas only.

Your suggestions for the conduct of the 1978 Needs Survey are appreciated and will be considered in developing the guidance for that survey.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J.A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: James Kutzman, USEPA Region IV
Needs Survey Coordinator

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CALVIN L. RAMPTON
Governor

PAUL S. ROSE
Executive Director

1896

STATE OF UTAH—DEPARTMENT OF SOCIAL SERVICES

Board of Health
Air Conservation Committee
Health Facilities Council
Medical Examiner Committee
Nursing Home Advisory Council
Water Pollution Committee

DIVISION OF HEALTH
44 MEDICAL DRIVE
SALT LAKE CITY, UTAH 84113
AREA CODE 801
533-6146

Environmental Health Services Branch
72 East 4th South
Salt Lake City, Utah

LYMAN J. OLSEN, M.D., M.P.H.
Director of Health

November 29, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 Main Street, S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

We have completed our review of the draft report entitled "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" and would like to offer the following comments regarding the contents of this report.

Although it appears that the methodology described in the report will provide a uniform and consistent means of calculating the national needs for Categories V and VI, we feel there are shortcomings in the methodology which ignore certain State requirements. For instance, the criteria used for calculating the needs for Category VI, Treatment and/or Control of Stormwater are based on uniform water quality criteria and the assimilative capacity of the receiving water rather than individual States' water quality standards. The water quality criteria used are generally less stringent than Utah water quality standards; therefore, the costs to meet Utah standards would be somewhat greater than those costs shown in the report. Dissolved oxygen (D.O.) in lieu of BOD_5 is used extensively to define water quality in the report and the minimum of 4.0 and 5.0 mg/l as discussed is lower than the minimum D.O. acceptable limit of 5.5 mg/l established by the State of Utah for Class "C" waters.

In Appendix B, the stream classifications for Ogden, Provo, and Salt Lake City are designated as 2, 8 and 2 respectively. It is unclear as to how these designations were determined, but it appears that they should be more consistent inasmuch as they all have the same State water quality classification. We would like to know how the Appendix B classifications were arrived at.

If you have any questions, please feel free to call on us.

Very truly yours,

UTAH WATER POLLUTION COMMITTEE

Calvin K. Sudweeks
Executive Secretary

FCP:mc

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

Mr. Calvin K. Sudweeks
Executive Secretary
Utah Water Pollution Committee
44 Medical Drive
Salt Lake City, Utah 84113

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Sudweeks:

Thank you for your letter of November 29, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In regard to your comment on water quality standards, time and budget constraints required the use of uniform water quality criteria. The needs were analyzed to meet a receiving water dissolved oxygen concentration of 5.0 mg/l, which was utilized to define the required level of treatment. However, treatment of the stormwater runoff to meet D.O. standards was seldom required in areas without combined sewer overflows, due to low concentrations of BOD in the separate stormwater discharges.

The stream classifications shown in Appendix B of the Draft Report were determined by review of USGS gaging station information and review of USGS topographic maps. Ogden, Provo and Salt Lake City were designated as 2, 8 and 2, respectively. Provo was designated as 8, or lake, because it was determined that a significant portion of the urban runoff from the Provo urbanized area discharged directly to Utah Lake, while the discharges from Ogden and Salt Lake City are to individual stream systems.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: William Hormberg, USEPA Region VIII
Needs Survey Coordinator

State of Vermont

AGENCY OF ENVIRONMENTAL CONSERVATION

Montpelier, Vermont 05602
Division of Environmental Engineering

Department of Fish and Game
Department of Forest, Parks, and Recreation
Department of Water Resources
Environmental Board
Division of Environmental Engineering
Division of Environmental Protection
Natural Resources Conservation Council

December 1, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. St., S.W.
Washington, D.C. 20460

Re: Category V and VI Needs
State of Vermont

Dear Mr. Chamblee:

This office has reviewed the draft report on needs in Category V (combined sewer overflows) and Category VI (storm sewers) prepared by Jordan, Jones and Goulding, Inc. and Black, Crow and Eidsness, Inc.

In conjunction with this review, members of our staff recently attended the meeting held in Boston concerning the above. Of major concern to this Agency was the methodology and base data utilized in computing the needs in Category V and VI for the State of Vermont.

Category V; The total needs in this category are based on an APWA survey which was intended to generate a realistic estimate of the total number of acres of combined sewers within Vermont. It is our profound belief that response to this survey was inadequate to formulate an accurate assessment of the total acreage involved. The needs for the State of Vermont were based on 7,900 acres of combined sewers. Members of our staff utilizing infiltration/inflow analysis reports (which clearly define the limits of combined systems) have re-evaluated this figure and submit that the following is more representative of the actual conditions that prevail:

Rutland	4,300 acres
Newport	948 acres
St. Johnsbury	4,775 acres
Barton	72 acres
Bennington	40 acres
Springfield	575 acres
Lyndon	231 acres
Montpelier	1,900 acres
Windsor	212 acres
Bellows Falls	400 acres
Burlington	2,525 acres

The above yields a total acreage in the magnitude of 15,978 acres not 7,900 acres. Therefore, utilizing the dollars per acre cost for New Hampshire, the Category V needs for the State of Vermont are $69.19 million. We wish also to note that our 15,978 figure is low as we did not assess acreage in towns where maps weren't immediately available.

Category VI; The needs in this category were based on "Census defined urbanized areas". Due to the lack of urbanized areas, the State needs in the category have been calculated as being zero. We submit that, to use this criteria for a State such as Vermont, is totally inaccurate. The Water Quality needs do not disappear when an urbanized area does not exist. It is the State's opinion that there are several large communities where storm water discharges can degrade water quality and, under present laws, corrective action will have to be accomplished under this category at some future time. The following is a list of the communities with their respective (low side) control costs.

Community	Feet of Connecting Storm Sewer @ $70.00/l.f.	Sedimentation basins(s)	Total Costs
Burlington	31,680	4 @ 350,000	3,617,600.
St. Johnsbury	15,840	2 @ 350,000	1,808,800.
Newport City	15,840	1 plus pump sta.	1,608,800.
Rutland City	23,760	4 @ 350,000	3,063,200.
Bennington	21,120	3 @ 350,000	2,528,400.
St. Albans	21,120	2 @ 350,000	2,178,400.
Windsor	13,200	1 @ 350,000	1,274,000.
Springfield	13,200	1 plus pump sta.	1,424,000.
Hartford	21,120	2 @ 350,000	2,178,400.
Brattleboro	10,560	2 @ 350,000	1,439,200.
Winooski	10,560	1 @ 350,000	1,089,200.
Colchester F.D.#1	26,400	1 @ 200,000	2,048,000.
Shelburne F.D.#1&2	21,120	1 @ 200,000	1,678,400.
So. Burlington (Bartletts Bay)	10,560	1 @ 350,000	1,089,200.
		TOTAL =	27,025,600.

These figures are generated based on a map determination of interceptor footage required and a determination of the number of treatment facilities necessary to reasonably treat the discharges.

In conclusion, we wish to submit the previous estimates of needs in Category V and VI as being clearly more representative of the actual needs for the State of Vermont. We expect these figures to be reported to Congress.

Should you have any questions, please contact this office at 828-3345 (802).

Sincerely,

William C. Brinley for

Reginald A. LaRosa, Director
Environmental Engineering Division

RAL/lg

cc: Alfred Pelequin, N.E. Interstate Water Pollution Control Commission
Secretary Martin Johnson

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

8 JAN 1977

Mr. Reginald A. LaRosa, Director
Environmental Engineering Division
Agency of Environmental Conservation
Montpelier, Vermont 05602

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. LaRosa:

Thank you for your letter of December 1, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

In response to your specific comment on Category V, the combined sewered acreage for the State of Vermont was changed from the 7,900 acres, reported in the draft report, to the 15,978 listed in your letter. Utilizing the dollars per acre cost for urbanized area control in the State of New Hampshire, and considering the changes from the draft to the final report, the Vermont final Category needs are $161.722 million.

Your specific comment on Category VI requesting inclusion of non-urbanized areas for storm water control needs was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in a Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI. The term "Separate storm sewers" is defined as "a conveyance or system of conveyances..... located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of such designations, only urbanized areas can be included.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Charles Pease, Region I

State of Vermont

AGENCY OF ENVIRONMENTAL CONSERVATI

Department of Fish and Game
Department of Forest, Parks, and Recreation
Department of Water Resources
Environmental Board
Division of Environmental Engineering
Division of Environmental Protection
Natural Resources Conservation Council

Montpelier, Vermont 056
Division of Environmental Engineeri

RECEIVED
12 JAN

January 3, 1977

Mr. James A. Chamblee, Chief
Needs Assessment Section
U.S. Environmental Protection Agency (WH-547)
401 M St. S.W.
Washington, D.C. 20460

Re: 1976 Needs Survey
Category V and VI
State of Vermont

Dear Mr. Chamblee:

This office has reviewed your recent transmittal dated December 16, 1976 of the Final EPA Estimates for the 1976 Needs Survey for Categories V and VI and is in agreement with the revised figure of 161.722 million as presented for Category V.

With respect to Category VI, we wish to reference the information forwarded in our letter of December 1, 1976 (copy of same enclosed). Although there are no "census-defined urbanized areas" within the State of Vermont, we feel that a real need still exists requiring corrective measures be undertaken at some future time to prevent further degradation of the water quality of those bodies of water adjacent to our larger communities. The State of Vermont does not accept a zero need for Category VI as projected by EPA and respectfully requests that a figure of $27,025,600 be reported to Congress for this category as a separate State estimate.

Should you require any further information on this matter, please contact this office at (802)828-3345.

Sincerely,

William Brinley for RAL

Reginald A. LaRosa, P.E., Director
Environmental Engineering Division

RAL/DB/cc
Enclosure
cc: Alfred Peloquin, N.E. Interstate Water Pollution Control Commission
Charles Bishop, Environmental Protection Agency, Region I (w/enclosures)

[illegible] JAN 1977

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Reginal A. LaRosa, Director
Environmental Engineering Division
Agency of Environmental Conservation
Montpelier, Vermont 05602

RE: 1976 Needs Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. LaRosa:

Thank you for your letter of January 3, 1977, which transmits your estimate of $27,025,600 for Category VI and which concurs with the EPA cost estimate for Category V. We will include your estimate as well as the EPA cost estimates in our final report.

The final report, including all comments received from the States, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Charles Pease, USEPA Region I
Needs Survey Coordinator

COMMONWEALTH of VIRGINIA
STATE WATER CONTROL BOARD
2111 Hamilton Street

R. V. Davis
Executive Secretary

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November 23, 1976

Mr. Wen Huang
Sanitary Engineer
Facility Requirements Branch
Environmental Protection Agency
Waterside Mall Building
4th & M Streets, S.W.
Washington, DC 20460

Dear Wen:

I was glad to see you again in Philadelphia on November 17, 1976. I thought it was a useful meeting.

The tables contained in the copy of your November 3, 1976 memorandum "Review of Draft Report.... by J J & G, Inc. and B C & E, Inc." which was furnished me were truncated in copying. I would appreciate having full copies of these important tables.

I've seen various references to the EPA sewerage cost index, eg., on page 3-3 of the above-cited report and in your memorandum. Is there a tabulation of historical data on this cost index, and is it an overall national average or do separate regional indices also exist? I would appreciate any quantitative information you can supply, for if such exists in this office, I have not been able to find it.

Yours truly,

Dick

R. L. Hill
Regional Operations Coordinator

RLH:zmh

30 NOV 1976

Dr. R.L. Hill
Regional Operations Coordinator
Commonwealth of Virginia
State Water Control Board
2111 Hamilton Street
P.O. Box 11143
Richmond, Virginia 23230

Dear Dick:

It was nice to see you again in Philadelphia on November 17, 1976.

In response to your letter dated November 23, 1976, I enclose the following materials:

1. A table (# pages) attached to the memorandum "Review of Draft Report --- by JJ & G, Inc. and BC & E, Inc."
2. Engineering News Record Construction Cost Index Table
3. EPA Sewage Treatment Plant Construction Cost Index
4. EPA Sewer Construction Cost Index
5. City Multipliers for Treatment Plant Construction
6. City Multipliers for Sewer Construction

For the 1976 NEED Survey of CAtegories I through IV, we used EPA STP and Sewer Construction Cost indices. The city multipliers were used for regional consideration.

For the NEED Survey of Categories V and VI, construction cost index for Engineering News Record was primarily used. In order to include the regional factors in Categories V and VI, we also used the city multipliers for treatment plant and sewer construction.

If I can be of any further assistance, please do not hesitate to call.

Very truly yours,

Wen H. Huang, Ph.D, P.E.
Sanitary Engineer
Facility Requirement Branch

COMMONWEALTH of VIRGINIA
STATE WATER CONTROL BOARD
2111 Hamilton Street

R. V. Davis
Executive Secretary

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Richmond, Virginia 23230
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3 December 1976

CC#2298

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

We are responding to Mr. Rhett's letter of 22 October 1976 with our comments on the Jordan/Jones/Goulding and Black/Crow/Eidsness draft report "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" which was prepared under EPA contract to delineate Category V and VI needs nationwide and by individual States.

We will make a distinction between the technical quality of the report and the larger issue of how the results are going to be used.

We understand that the two consultant firms which authored the report had five to six months to develop it in toto. We feel that they did a reasonable job in the limited time available, in this field where firm detailed knowledge and experience are sparse. But we seriously question the advisability of using the State-by-State dollar figures, as set forth in the draft, for the purpose of allocating Federal construction grant funds among the States, although the national totals may provide an approximate indication of national needs undifferentiated by State. It seems clear that the methodology described in the draft could not possibly consider individual facility costs, or local/regional peculiarities, in the same detail as done by the localities and their consultants, the individual States, Dames & Moore, and EPA itself for Categories I through IVB needs in course of the 1976 Survey.

The draft report concedes that the individual-area estimates should be viewed with caution but claims that the State totals are sufficiently reliable to permit an equitable allocation of grant funds among the States. The 320 urbanized areas listed in the report represent an average of only about six per jurisdiction, which is a rather small number to rely on for "averaging out" of individual-area errors within a jurisdiction. Virginia will have roughly three times 320, rather than 6 or 8, individual facility needs to total for Categories I - IVB, which does provide real scope for countervailing errors to balance out.

The fundamental decisions to design for the "80% storm" and to grant full allowance for the assimilative capacity of the receiving waters appear to be quite sound, at least for "average" streams. Even with these concessions to economic reality, the aggregate 1990 capital costs for Categories V and VI needs to meet your Fish and Wildlife or Recreation protection goals run to $1.06 billion for Virginia and $40 billion for the nation, which we suspect are roughly half the corresponding Categories I through IVB needs. Considering the backlog for I through IVB, a major funding effort for VI at present seems out of the question unless you wish to make a major diversion of available funds to the detriment of the I through IVB program, which we would view as most unwise.

It is noted that the current capital requirements for Category VI are only about half the 1990 capital requirements. If VI needs must be funded soon, it would appear most reasonable to allocate on the basis of current, not 1990 needs for this category.

Considering that the major portion of the total cost of stormwater management/control, whether for combined sewers (Category V) or not (Category VI), will lie in collection and transmission facilities, it seems appropriate to provide treatment capability at least sufficient to meet your Recreation criteria, even in "average" waters not characterized by special uses for which a higher level of treatment might be desirable. (It is realized that EPA may never fund general stormwater collection and transmission, but our contention is independent of who funds the construction work.) Furthermore, the cost differential between Recreation and Fish and Wildlife protection is negligible, and the disinfection step provided in the former appears to us to be well worth its small incremental cost if it can be made effective. To skimp on treatment quality will be poor economy.

However, we do not believe that stormwater effluent containing 80 mg suspended solids per liter can be reliably or effectively disinfected. This issue is crucial in swimming areas like Virginia Beach, Buckroe Beach, and Colonial Beach, and even more crucial in shellfish waters, of which Virginia has 500,000 acres. If the full benefit of controlling stormwater runoff to shellfish and swimming waters is to be realized, it will be necessary to reduce the average suspended solids load to 30 mg/l or at worst 40, during all save peak periods, then to disinfect.

In further reference to shellfish protection, an additional defect of the draft report in our view is the heavy emphasis placed on "urbanized" areas, which are substantially equivalent to SMSAs, having population greater than 50,000. Aside from Hampton Roads area, there are no such major urban areas adjacent to shellfish waters in Virginia. Yet, of the 500,000 acreas total of such waters, 100,000 acres of productive non-marginal waters are condemned. We have attempted to unambiguously identify the causes of these condemnations on an individual basis, but without much success. We do know that we have made substantial progress in controlling animal wastes and municipal/industrial point sources, as attested by rescission of prior condemnations on some 80,000 acres. It is becoming increasingly evident that, even with all point sources controlled, a task by no means yet completed, sizeable acreages will remain condemned in waters abutting populated areas including small towns having a population far below 50,000. The condemned Lynnhaven Bay oyster ground on Virginia Beach's north shore, although not exemplary of the smaller-town non-urbanized category, is a prime example of the need to control non-point sources including stormwater for shellfish protection. We believe that the same control need exists in most of the towns adjacent to shellfish waters.

EPA has already devoted considerable effort to shellfish protection; witness your Technical Bulletins 430-99-74-001 and 430/9-74-010 to name but two. Consistency demands that stormwater facilities discharging into shellfish waters be of a character akin to Reliability Class I. While we are unable to cite a rule-of-thumb for the incremental cost which such reliability entails, we believe it will be significant. Yet the draft report makes no allowance for it. The defect applies to both Category V and VI. However, it will not be major for Category V in Virginia because we have only one combined sewer area in the shellfish water territory, and that one is small.

The draft report took no cognizance of and made no allowance for combined-sewer non-urbanized areas in Virginia, of which there are seven. Additionally, we have six urbanized areas with combined sewers, of which only five were identified in the draft report. It grieves us to advise that the acreages of three of these five are overestimated in the draft, to the extent that the corrected total combined-sewer acreage for Virginia (see enclosure) is less than that reported in the draft, notwithstanding your consultants' omissions. Correction of these omissions might be to Virginia's detriment (that is not entirely clear), but we suspect that a similar review of other States' data might well result in similar downward adjustments thereof.

We have not been privileged to review the December 1975 APWA/U. of Florida draft report to EPA (reference 2, Part III), but the JJG/BCE report now at issue places heavy reliance on this one, and on a much earlier one (1967) by APWA the currency of which is dubious. In short, it appears that your consultants' data base may have been inferior to that which could have been used given more time to conduct the study.

It would have been helpful if the draft had shown dollar needs estimates for each of the 320 urbanized areas, at minimum, for the separate Categories V and VI.

Presumably Mr. Wen Huang's cost equations will be incorporated in the revised final report and the facility costs will be recomputed accordingly. We would expect the dollar needs to rise appreciably if this is done.

This agency sent a representative to the November 1976 EPA Regional meeting on the draft report, at which spokesmen for the authors made explanatory presentations aided by slides. We think that many of those slides not now present in the draft would be helpful in the final report. In particular, inclusion of the five process schematic diagrams would add strength. The control strategies used to satisfy the Aesthetics, Fish and Wildlife, and Recreation goals respectively, though mentioned in the text, could be set forth in tabular form for clarification and emphasis.

The term "construction practices" should be clearly defined as erosion/sedimentation control practices implemented in course of ground-disturbing construction (and other?) activities, or whatever is intended.

We would have liked to see a closer analysis of (a) the fraction of total stormwater volume which actually receives treatment, and (b) the fraction of total pollutant poundage in stormwater which actually receives treatment and also (a different matter!) which actually gets removed, as a function of (c) the design storm depth variable. An analysis of the dependence of overall control costs on the volume and degree of treatment provided would also be useful. We realize that such analyses could probably only be conducted for a few representative geographic/climatic/urban development situations.

We appreciate having had the opportunity to review the draft report. Notwithstanding our reservations, the report is a significant addition to the literature of stormwater management.

Sincerely yours,

R. V. Davis

R. V. Davis
Executive Secretary

/ap

cc: Mr. Kenneth Pantuck, EPA III

Combined Sewer Areas in Virginia
November 1976 State Water Control Board Update

Area Name	CSO Area Acreage Draft report a)	 SWCB update b)
"Urbanized" Areas (SMSAs) c)		
Lynchburg	10,400	10,425
Newport News	0	268
Norfolk	0	0
Petersburg	0	0
Richmond	15,900	11,500 d)
Roanoke	300	300
Va. portion D.C. Metro (Alexandria)	1,500	885
Va. portion Kingsport Metro (Bristol)	0	805
Subtotal	28,100	24,183
"Non-urbanized" Areas		
Radford, City	0	321.5
Clifton Forge, City	0	480
Dayton, Town	0	(0) e)
Waynesboro, City	0	175
Ashland, Town	0	211
Hopewell, City	0	450
Pocahontas, Town	0	486
Subtotal	0	2,124
Grand Total	28,100	26,307

a) Jordan et al. and Black et al., October 1976 draft report to EPA
b) from agency files and locality contacts
c) all eight Virginia SMSAs are listed
d) Greeley & Hansen Engineers' 1970 study says 10,361 acres
e) minor CSO needs are being handled by the Town and State

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. R. V. Davis, Executive Secretary
Virginia Water Control Board
2111 Hamilton Street
Post Office Box 11143
Richmond, Virginia 23230

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflow and Stormwater

Dear Mr. Davis:

Thank you for your letter of December 3, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

Your comment discussing inclusion of smaller communities for stormwater control needs was voiced by several states. Regulations for the application of the NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permitting program it established were utilized to define the areas requiring needs in Category VI. In the regulations the term "separate storm sewer" is defined as "a conveyance or system of conveyances.....located in urbanized area and primarily operated for the purpose of collecting and conveying stormwater runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of such specific designations, stormwater needs are estimated for Census-defined urbanized areas only.

It is unfortunate that time and budget constraints would not allow as detailed an evaluation of Category V and VI needs as was accomplished in Categories I through IVB.

Several of your comments related to changes which were discussed in the regional meeting in Philadelphia. After making these changes (which included Dr. Wen Huang's cost equations) and increasing the design storm volume (DS) for combined sewers to the 90th percentile storm for the aesthetics and fish and wildlife criteria (DS=2.3 x MRF, where MRF = means rainfall depth per stprm) and the 98th percentile storm for the recreation crieria (DS=3.91 x MRF), the final Virginia needs estimates for the recreation criteria are \$244,947,000 for Category V and \$1,550,490,000 for Category VI. The increase in design storm between the fish and wildlife criteria and the recreation criteria will provide greater assurance of meeting the water quality criteria in the shellfish areas near your urbanized areas.

Reproduced from best available copy.

The suspended solids criteria defined in the water quality criteria were obtained in research conducted by the European Inlands Fishery Commission. Unquestionably, more research needs to be done on the impact of suspended solids from stormwater runoff and the implications of suspended solids concentrations on disinfection.

The changes in the input data base enclosed in your letter were included in the final report and were used to develop the final estimate. As you mentioned, several portions of the available data base were minimal at best. Completion of ongoing 208 studies and other storm water studies may provide a more detailed data base for future needs surveys.

In an attempt to write a concise report that would be reviewed by the states and other reviewers, certain specific data such as individual urbanized area needs, process schematic diagrams, and tabulations of design storm size treatment rates, and other incremental pieces of data were deleted from the draft report. This information is available upon request.

We agree that analysis of specific relationships in the cost function and treatment rate assumptions would be interesting. Although not possible within current time constraints, the computer program of our model could be modified to produce such information.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

2 JAN 19 jc

COMMONWEALTH of VIRGINIA

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Executive Secretary

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January 5, 1977

Mr. James A. Chamblee, Chief
Needs Assessment Section WH-547
U.S. Environmental Protection Agency
401 M Street S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

We have your 16 December letter concerning the 1976 Needs Survey Categories V and VI Final EPA Estimates.

We have no technical basis on which to challenge the figures for Virginia and we take no exception to them.

We do feel that in upcoming formulae for allocation of construction grant funds among the States, Categories V and VI should be weighted considerably lower than Categories I through IVB, if indeed Categories V and VI are included at all.

Sincerely yours,

R. V. Davis
Executive Secretary

/ap

cc: Mr. Kenneth C. Pantuck
Dr. Richard L. Hill

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

Mr. R. V. Davis
Executive Secretary
State Water Control Board
Commonwealth of Virginia
2111 Hamilton Street
Post Office Box 11143
Richmond, Virginia 23230

Re: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Davis:

Thank you for your letter of January 5, 1977 in which you concur with the EPA Category V and VI cost estimates for the Commonwealth of Virginia.

The final report, including all comments received from the States, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section (WH-547)

cc: Ken Pantuck, USEPA, Region III
Needs Survey Coordinator

State of Washington
Department of Ecology

November 30, 1976

Mr. James Chamblee
Chief, "Needs" Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

Considering the existing time and monetary restraints, the quality of the report entitled 1976 Survey of Needs for Control of Pollution From Combined Sewer Overflows and Storm Water Discharges could be described, at best, as barely adequate.

In general, the Environmental Protection Agency (EPA), in gathering data for the report, has chosen an approach that: 1) does not conform with their existing guidance for the construction grants program; 2) does not take into account a significant percentage of the needs in combined sewer and storm sewer discharge correction; and 3) does not properly utilize existing data.

The EPA's program guidance memorandum 61 requires combined sewer correction programs to be justified on the basis of impairment of a beneficial use; therefore, the time of the year at which the overflows occur becomes the deciding factor. This time-of-year factor should be a major element in EPA's approach to the problem.

EPA guidance stipulates that facility planning decisions are to be for the 20-year planning period, so it seems reasonable that estimates of "needs" should be based on the same ground rules as these 20-year decisions; however, the "needs" estimates are not.

The "needs" survey estimates cover only the major metropolitan areas, leaving out many of the communities in the State with combined sewer problems, e.g., Bremerton, Aberdeen, Everett, Bellingham, Mount Vernon, Anacortes, Olympia, Hoquiam, Raymond, Vancouver, Walla Walla, etc. These cities represent 30 percent or more of our "needs" in Category V. In the past, states have developed their own estimates because national surveys fail to take into account the uniqueness of each state. For a state such as Washington, which has frequent rainfall events and many combined systems, the approach used to determine this year's "needs" estimates for Category V is grossly inadequate.

Daniel J. Evans, *Governor*   John A. Biggs, *Director*   Olympia, Washington 98504   Telephone (206) 753-2800

The use of existing data was an approach ignored by EPA in arriving at their estimates. The $5.3 million worth of facilities planning data on the Seattle, Tacoma, Everett, and Spokane areas were not utilized, and an additional $1 million worth of facilities planning data for other areas were not used. The $4.4 million "RIBCO" study, funded by grants from HUD, EPA, COE, City of Seattle, and the State of Washington was totally ignored. A major goal of the RIBCO study was to define storm water problems in the Seattle metropolitan area and recommend solutions to these problems. Two years ago, the Department of Ecology funded an $8,000 study which included development of an empirical methodology for estimating storm water "needs,"and DOE contributed an additional 200 man-hours to this study, but no use was made of this effort by EPA. We have not, by any means, mentioned all the available work, but it seems clear that EPA chose a $90,000 theoretical model approach rather than to utilize the millions of dollars worth of specific studies already completed in Washington State under local, state, and federal grants.

In addition to the overall approach, the methodology used also has some areas which could be improved. First of all, the mathematical model does not consider whether or not the sewers are flowing full or near full prior to a rain event. If either of these situations exist, the sewer may overflow with only 0.01-0.02 inches of rainfall. A high ground-water table in early spring or summer may cause infiltration not correlated with a storm, and may cause overflows to occur with minimal precipitation during a time when use of the receiving water is high.

The model does not take into account that I/I rehabilitation of the system cannot take place upstream of the overflow unless the overflow is eliminated, so the cost effective solution in many instances may be treatment at the plant or separation of the system. The costs in these instances may be higher than predicted.

The model is based on fish and wildlife criteria that are adequate for minimal fisheries production, but would by no means be acceptable in this state where fisheries is one of our major industries. D.O. levels of 5 mg/l could significantly effect salmon reproduction and rearing; and sedimentation, even at 80 mg/l Suspended Solids, could destroy valuable spawning beds.

The criteria for recreation does not take into consideration nutrient impacts on freshwater lakes. This is a severe problem both in Seattle and Spokane, e.g., Long Lake in Spokane was closed this summer due to a toxic anabaena bloom.

In order for this survey to reflect the true cost of correction of our State's storm water related problems, at least the problems with the methodology must be addressed; and more than likely, a complete reversal in the approach should be considered.

Sincerely,

John F Spencer

John Spencer
Assistant Director
Office of Water Programs

JS:FM:pam
112920

cc:Russell Train, EPA Headquarters
Donald DuBois, EPA, Region X

27 DEC 1976

Mr. John F. Spencer,
Assistant Director
Office of Water Programs
Department of Ecology
State of Washington
Olympia, Washington 98504

Dear Mr. Spencer:

Thank you for your letter of November 30, 1976, on the draft report, "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges."

This is to confirm that we would like very much to see a copy of the facility plans and the "RIBCO" study as well as your Department's report on an empirical methodology for estimating stormwater "needs", which Mr. Philip Graham requested by phone. They will help us to determine the reasons for differences between our estimates and those in the studies.

I would note that we did consider the time-of-year factor in the methodology. The parameter used to take the time-of-year into consideration is the average annual summer flow shown for the State of Washington on Page B-16 of our draft report. The data were obtained from five years of record. The lowest three months flows for each year were averaged. If summer flows and winter flows were approximately equal, the summer flow data were used to determine the three month period with low oxygen resource. Needs in the Survey are, as you noticed, based on 1990 population. The decision to use 1990 population was made by the State and EPA Needs Survey Working Group to minimize the changes between 1974 and 1976 Needs Surveys.

Category V needs for Washington were based on an estimate of 57,300 acres in Seattle and Spokane, and an additional area of 21,800 acres for non-urbanized areas. This additional area represents 27% of your states' combined sewer area.

The variation in number of rainfall events per year for each urbanized area is considered in the model as the number of storms per year and average yearly depth of rainfall. For example, compare data for Seattle on page B-16, which shows 34.10 inches precipitation occurring as 164 storms per year, with data for Spokane, which shows an annual precipitation of 17.19 inches distributed over 118 storm events per year. The use of this data is described in the computer program on Page C-4 lines 16-18, and in the report on page 7-11, and in more detail on pages 6-1 to 6-5.

You commented that, at certain times, due to groundwater causing infiltration not correlated with a storm, only one to two-hundredths of an inch of rainfall can cause an overflow event from a combined sewer overflow, and that our methodology does not consider whether combined sewers are full prior to a rain event. Our methodology provides for storage at each overflow point and transmission to regionalized combined sewer overflow treatment plants. In the model, all stormwater collected in the combined sewer area is assumed to overflow (at combined sewer overflow concentrations) to the combined sewer overflow storage-transmission-treatment system. Thus our methodology does not rely on the capacity of the existing combined sewer system and, to the extent this existing capacity may be used, our dollar estimates are high.

You commented that the cost-effective solution in many instances may be treatment at the plant or separation of the system. You also commented in a subsequent paragraph that sedimentation even at 80 mg/l suspended solids could destroy valuable spawning beds. Under the sewer separation alternative, unless treatment is provided for the separated storm sewer system, the suspended sediment load from urban stormwater runoff would be delivered to the receiving water with likelihood of higher suspended solids concentrations in the receiving water than with combined sewer overflow treatment alternatives. If it is more cost-effective to separate combined sewer systems, the costs should include the cost of treating stormwater runoff from the separate storm sewer system and the resulting total cost of separation of the combined sewer system should also be lower than the cost determined using the combined sewer overflow storage-transmission-treatment alternative of our 1976 needs survey.

We would be interested to know if the spawning beds you discussed are located in streams which receive combined sewer overflows or stormwater runoff from urbanized areas (which is the current scope of Category V and VI of the Needs Survey).

You commented that the recreation criteria do not take into consideration nutrient impacts on freshwater lakes. There is some nutrient removal associated with the processes listed in on pages 3-4 through 3-13 of the draft report, though we would be very interested in your analysis of the extent to which nutrient removal from combined sewer overflows and stormwater flows is required in your State.

We are looking forward to receiving the studies mentioned in your letter.

Yours sincerely,

James Chamblee
Chief
Needs Survey
Facility Requirements Branch (WH-547)

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

IRA S. LATIMER, Jr.
Director

December 7, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH 547)
401 'M' Street, SW
Washington, D. C. 20460

Re: Draft 1976 Survey Of Needs For Control Of Pollution From Combined Sewer Overflows and Stormwater Discharges

Dear Mr. Chamblee:

We have received the subject draft report and appreciate the opportunity afforded to us to comment on this important document.

In keeping with the instructions included in the transmittal letter to this agency from the Deputy Administrator, our comment on this draft concerns the base input data contained in Appendix 'B'. In our opinion, those areas in West Virginia chosen for and included in this appendix cannot be considered as representative cases for analysis. As a state with small and rural communities the rule and the metropolitan (SMSA) area the exception, the chance of having our needs in categories V and VI accurately represented is extremely slight. We feel that the selection of those communities with populations greater than or equal to 50,000 presents an exceedingly good likelihood for a distortion of true needs. The selected communities, four in number, occur in only two of our seven river basins. Both of these streams, the Ohio River and the Kanawha River, maintain relatively large flow volumes, even in periods of lowest flow.

Additionally, if only by virtue of their proximity to one-another, these communities present a similarity in topographic features and geographic setting. Beyond that, existing facilities are remarkably similar in the selected communities, as are their needs for modifications and improvements to those systems.

Our point is that utilization of the communities selected as input data will not clearly reflect the image of in-state needs, as we see it, since only a small percentage of the total state population will have been included and the communities selected are not representative of the type found in

December 7, 1976

other areas of the state which do contain the largest percentage of total population. Further, in that the communities selected as data points for the survey all occur on high average flow streams, even the magnitude of the impact that this percentage of the storm flow and combined sewer overflow which will be addressed may well be of lesser significance in comparison to the serious impacts upon stream quality that the present unrestricted flows from the typical small community would have upon its similarly small volume receiving stream. We offer the suggestion that the impact of these flows may well be of greater significance in terms of water quality degradation in the smaller stream than those in the sample group.

To simplify our position, it is that as state administering agency, we are deeply concerned about state needs, not those needs of four SMSA's to the exclusion of all else.

While it was clearly stated in the letter of transmittal that the methodology "is not intended to predict accurately the needs for any specific area", the application of this methodology to this state appears to consider the needs only of a specific area. If future allocations of funds to states may be determined in part by estimated needs in categories V and VI, we would be particularly interested in seeing that these estimated needs approach closely the actual needs of our state.

We hope that you will consider our viewpoint in the time available before adoption of the methodology and can adjust or factor results accordingly so that you will deliver an output from the survey which will provide a consistent basis for comparison of needs among the states, rather than a comparison of their populations alone.

Sincerely,

WATER RESOURCES DIVISION

Steven J Knopp

Steven J. Knopp, Planner
Construction Grants Section
Municipal Branch

SJK/lt
c: John Hall, Chief,
Div. of Water Resources

Warren Means, Ass't. Chief
Municipal Grants Branch

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

Mr. Stephen J. Knopp
Planner Construction Grant Section
Municipal Branch
West Virginia Department of Natural Resources
Charleston, West Virginia 25305

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Knopp:

Thank you for your letter of December 7, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V and VI).

Your specific comment requesting inclusion of smaller communitites for stormwater control needs was voiced by several states. Regulations for the application of the NPDES Program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established was utilized to define the areas requiring needs in Category VI.

In the regulations, the term "separate storm sewer" is defined as "A conveyance or system of conveyances....located in an urbanized area and primarily operated for the purpose of collecting an conveying storm water runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, storm water needs are estimated for Census-defined urbanized areas only.

The urbanized areas were also used to define dollars per acre cost for combined sewer overflow control in each state. These dollars per acre costs were then applied to other combined severed areas outside the urbanized area to estimate the total Category V needs.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J A Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

12 JAN 1977

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

IRA S. LATIMER, Jr.
Director

January 5, 1977

Mr. James Chamblee
Chief, Needs Assessment Section
Facilities Requirements Branch
Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

Re: 1976 Needs Survey Categories
V and VI Final Estimates

Dear Mr. Chamblee:

We have received and reviewed the final estimates for categories V and VI attached to your 16 December memorandum. From these estimates, we have determined that our comments concerning the inapplicability of the category V and VI methodology to the general or specific case in West Virginia have been ignored. We strongly feel that the unrepresentative nature of the base data has yielded a product which neglects the needs, not only our predominantly small, rural communities, but also the significant impacts which combined sewer overflows and storm flows have upon our smaller streams with considerable existing water quality problems.

Evaluation of this problem by our staff members has produced the conclusion that the final estimates which have been presented to us are highly suspect. We are also disturbed that the printing schedule for your final report allows us less than thirty calendar days over a holiday period to complete estimates to rebut estimates generated by EPA consulting engineers over a period of several months. The only course left to us is to register our dissatisfaction with the estimates which you have presented, and enter as the independent state cost estimate for category VI those final figures generated in the 1974 needs survey adjusted by inflation modifiers to reflect needs in January 1976 dollars. Our calculation of category VI needs is $2,454,010,530.00 (or $1,740,433 thousands of 1973 dollars x 1.41 inflation modifier).

Those figures were generated by our large 1974 needs survey staff who utilized not only considerable personal expertise in the estimation process, but also the staff resources of private consulting engineers who are most familiar with the needs of their individual clients, those smaller communities totally neglected by your statistical approach. We feel these figures to be most representative of the true needs of our state and will greatly appreciate your attention to the interests of the remaining 1.62 million people which they and we represent.

Very truly yours,

WATER RESOURCES DIVISION

John H. Hall

John H. Hall
Chief

JHH/skt
c: Honorable Robert C. Byrd, U. S. Senator
Honorable Jennings Randolph, U. S. Senator
Honorable Arch A. Moore, Jr., Governor
Governor-Elect Jay Rockefeller

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

26 JAN 1977

Mr. John H. Hall, Chief
Water Resources Division
West Virginia Department of Natural Resources
Charleston, West Virginia 25305

RE: 1976 Needs Survey for Combined Sewer Overflows
and Stormwater

Dear Mr. Hall:

Thank you for your letter of January 5, 1977, which transmits your estimate of $2,454,010,530 for Category VI. We will include your estimate as well as the EPA estimates reported to you on December 16, 1976.

The final report, including all comments received from the States, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

RECEIVED
2/1/77

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S. Earl
Secretary

BOX 7921
MADISON, WISCONSIN 53707

January 24, 1977

3430
IN REPLY REFER TO:

Mr. James A. Chamblee, Chief
Needs Assessment Section WH-547
Environmental Protection Agency
401 M Street S.W.
Washington, D. C. 20460

RE: Estimate of Wisconsin Category V Needs

Dear Mr. Chamblee:

We have reviewed the draft document, "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges." We consider the costs of Category V (Combined Sewers) to be too low. The following are our comments regarding the combined sewer overflow problems in the State of Wisconsin.

The given task of the contractors was to estimate costs for treatment of combined sewer overflows only. No consideration is given to costs of land and relocation assistance as required by 40 CFR Part 4, the need for combined sewer system separation to eliminate basement backups, or treatment plant expansion to provide at least secondary treatment to the I/I from storm water that reaches the treatment plant, as required by 40 CFR Part 133.

The costs are based on removing pollution from combined sewer overflows by building holding ponds and treatment facilities at the holding ponds. The following assumptions were made:

1. The holding ponds and facilities would collect and treat the overflow from 80% of the five-year storms. Any additional overflow would not be treated.

2. Suspended solids in the effluent from the treatment facilities would be less than 400 mg/l for Fish and Wildlife Criteria and Recreation Criteria.

3. BOD would be removed to a level that would provide a minimum of 5.0 mg/l of dissolved oxygen in the receiving stream for criteria other than Aesthetics. Only under exceptional pollution loads where the dissolved oxygen in the receiving water would be less than 5.0 mg/l were additional point source treatment plant costs considered.

4. Costs for chlorination were estimated to limit fecal coliform only where the receiving water quality is to meet the Recreation Criteria.

The estimated costs for Category V, Combined Sewer Overflow Correction or Control, are too low for the following reasons:

1. To meet the recommendations of international compacts, Wisconsin has agreed to require phosphorus removal from effluent from wastewater treatment plants of all communities over 2,500 population discharging in the Great Lakes Basin. No costs are included for this removal.

2. Federal Regulation 40 CFP Part 133 indicates that all municipal treatment facilities are to provide an effluent not to exceed a monthly average of 30 mg/l of BOD_5 and suspended solids, nor a weekly average of 45 mg/l of BOD_5 and suspended solids. These limits also apply to combined sewer overflow treatment facilities.

3. Apparently no consideration was given to separation of combined sewers to eliminate basements being partially filled with wastewater from surcharged combined sewers.

4. The City of Racine has combined sewers in 1.5 square miles of its municipal area.

From data available to us, we estimate the costs for correction of combined sewer overflow problems of five municipalities as of January 1, 1976 as follows:

Name	Estimated Cost millions of dollars
Milwaukee Metropolitan Sewerage District	400
City of Racine	15
City of Kenosha	30
City of Wisconsin Rapids	8
City of Superior	11
Total	464

It is requested that calculated costs of combined sewer overflow control for the urbanized areas of Appleton, Green Bay and La Crosse and the non-urbanized areas of the state other than Wisconsin Rapids and Superior, as determined by the 1976 Needs Survey, be added to the estimated cost of $464 million. It is our belief that this revised total cost will more accurately present the Category V needs of the State of Wisconsin.

Sincerely,
Department of Natural Resources

Paul Guthrie, Jr., Director
Office of Intergovernmental Programs

cc: Edwin Horne, Jr., EPA-Region V

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. Paul Guthrie, Jr., Director
Office of Intergovernmental Programs
Wisconsin Department of Natural Resources
Box 7921
Madison, Wisconsin 53707

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater Control

Dear Mr. Guthrie:

Thank you for your letter of January 24, 1977, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V and VI).

In regard to your comment that no consideration is given to land cost, land costs are considered ineligible for the purposes of the municipal facilities grants program of EPA except for land treatment of wastewater or for sludge disposal. I have enclosed copies of PGM's 49 and 67 which state these policies in more detail.

In regard to your comment that no consideration is given to relocation costs, costs amounting to 25% of the costs determined from the cost equations are included in our cost estimates; relocation costs are included in this additional amount.

In regard to your comment that no consideration is given to the cost of the separation of combined sewers to eliminate basements being partially filled with wastewater from surcharged combined sewers, the cost estimates of the 1976 Needs Survey are for single purpose projects only to protect receiving water quality. Sewer separation was not considered as an alternative control option because it has been shown in most cases across the nation not to be a cost-effective means of reducing pollutant discharges to receiving waters. I have enclosed a copy of PGM 61 and PRM 77-4 which summarize EPA's policies on the control of combined sewer overflows and on cost allocations for multiple purpose projects.

In regard to your comment that treatment plant expansion costs should be included to provide at least secondary treatment to the non-excessive infiltration/inflow from storm water that reaches the treatment plant, the guidance for Categories I-IV states that these costs should belong in Category I or II where a separate sanitary sewer is involved. Where a combined sewer is involved, treatment costs of infiltration and inflow are included in Category V.

In regard to your comments on the combined sewer overflow cost estimation methodology, the costs in the final report are based on (1) storage at each overflow site sized for a 98th percentile storm, and (2) treatment of the stored volume at consolidated treatment facilities during the average interstorm period. The Category V and VI cost estimates reported to Congress are for the recreational water quality criteria and thus disinfection costs are included for all combined sewer overflow areas.

In regard to your comment on phosphorus removed, costs for treatment of wastewater to a level higher than secondary should be included in Category II.

In regard to your comment that combined sewer overflows require secondary treatment, EPA does not interpret secondary treatment requirements of the 1972 FWPCAA to apply to combined sewer overflows. The policy is to provide that degree of pollution control which is cost-effective and needed to protect beneficial uses (please refer to PG-61).

Our final cost estimates were prepared January 21, 1977; we are sorry that we did not receive your data about the Racine, Wisconsin combined sewer area in time for the 1976 Needs Survey.

Per the telephone conversation between Mr. Philip Graham and Mr. John Hario on February 1, 1977, I will include your separate State estimate for Category V of $495 million and note that you do not wish to submit a separate State estimate for Category VI for Wisconsin.

The final report, including all comments, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee
Needs Survey Director (WH-547)

Enclosures

cc: Ted Horn, USEPA Region V
Needs Survey Coordinator

OFFICE OF
XXXXXXXXXXXX
Natural Resources Management

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES

Refer to:
NRM:PF:11

—— 0 ——

Department of Conservation and Cultural Affairs
P. O. BOX XXX 4340
CHARLOTTE AMALIE, ST. THOMAS

November 5, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. St., S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

I have received the Draft Report entitled, "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" and was disappointed to see that the Virgin Islands, Guam, American Samoa, and the Pacific Trust Territories were listed as having no Capital Costs for State Category VI, (Stormwater) Needs.

The Virgin Islands were excluded, I believe, on the basis that there is no urbanized city with 50,000 or more population. The survey implies that we have no stormwater run-off problem. This is not so, and I am sure the same thing applies to the other small islands.

I believe a fairer analysis would be to consider the percentage of land area urbanized in relation to the total land area available. For in reality the Virgin Islands with the exception of St. John, are almost totally urbanized.

Sincerely yours,

Pedrito Francois, Director
Natural Resources Management

cc: Commissioner Brown

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

16 NOV 1976

Mr. Pedrito Francois, Director
Natural Resources Management Division
Department of Conservation and Cultural
Affairs, P.O. Box 4340
Charlotte Amalie, St. Thomas, VI 00801

Dear Mr. Francois:

Thank you for your comments on our draft report on needs for combined sewer overflow and stormwater control (Categories V and VI).

Your comments are being studied carefully and will be taken into consideration in our final report to the Congress.

We are sorry that we cannot yet comment on the issues your letter raised. These are under study, along with comments from other states and territories.

As soon as possible, a complete explanation of our final cost estimates will be forwarded.

Sincerely,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. Pedrito Francois, Director
Natural Resources Management
Department of Conservation and Cultural Affairs
Government of the Virgin Islands of the United States
Post Office Box 4340
Charlotte Amalie, Saint Thomas

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Francois:

Thank you for your letter of November 5, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V and VI).

Your specific comment requesting an inclusion of non-urbanized areas for stormwater control needs was voiced by several States as well. Regulations for the application of NPDES program to separate storm sewers were published in the Federal Register of March 18, 1976. This document and the permit program it established were utilized to determine the areas requiring needs in Category VI.

In the regulations, the term "separate storm sewer" is defined as "a system or system of conveyances.....located in an urbanized area and primarily operated for the purposed of collecting and conveying stormwater runoff." The permit issuing authority may designate other storm sewers as being significant contributors of pollution and thus subject to these regulations. In the absence of specific designations, stormwater needs are estimated for Census defined urbanized areas only.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered questions. If I can be of any further assistance, please let me know.

Sincerely yours,

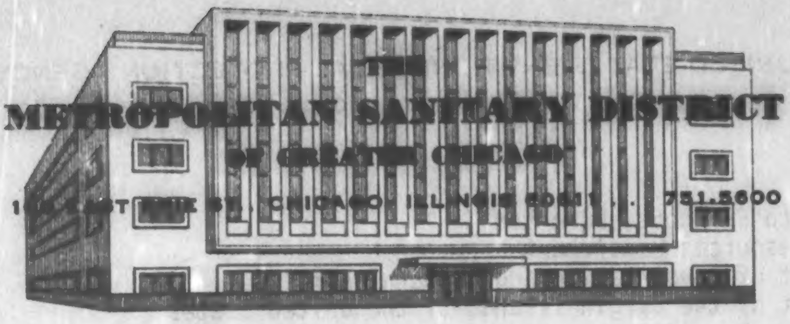
J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Olson, Region II

NICHOLAS J. MELAS
PRESIDENT

Bart T. Lynam
General Superintendent
751-5722



THE
METROPOLITAN SANITARY DISTRICT
OF GREATER CHICAGO
100 EAST ERIE ST. CHICAGO, ILLINOIS 60611 751-5600

BOARD OF TRUSTEES
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November 22, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street, S.W.
Washington, D. C. 20460

Dear Jim:

In response to Hal's October 27 request to review the Draft on the 1976 Survey of Needs for Combined Sewer Overflows, the following comments are made:

1. It appears that the sequence of storm events has not been given due consideration and could result in a gross underestimation of the total needs.
2. Utilization of a design rainfall of only 1.6 times the average rainfall may not achieve the objective of having a design rainfall greater than 80% of the annual rainfall.
3. The combined sewer overflow area indicated in Appendix B for the Chicago Area is approximately 320 square miles. The District's Facilities Planning Study indicates the combined sewer area of approximately 375 square miles.

If you require any additional information, please feel free to contact me.

Very truly yours,

Bart T. Lynam

Bart T. Lynam
General Superintendent

HM
BTL:HM:kl
cc: Mr. McMillan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. Bart T. Lynam
General Superintendent
Metropolitan Sanitary District of Greater Chicago
100 E. Erie Street
Chicago, Illinois 60611

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Lynam:

Thank you for your letter of November 22, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The following is in response to your specific comments:

1. The sequencing of storm events has significant impact on the percentage of total runoff treated and the percentage of annual runoff captured. However, when storm events are separated by short time durations, the concentration of pollutants in the latter storm events are lower than those of earlier storm events. A sensitivity analysis of the results from the computer model show that there is only a ten percent increase in the total cost for combined sewer control by increasing treatment rates and decreasing storage volumes such that the captured volume is treated over one day as opposed to treating over the average time between storms, which is assumed in the draft report.

2. After receiving comments from the states, the design storm for combined sewer control was changed to the 90th percentile storm for the aesthetics and fish and wildlife criteria (DS=2.3 x MRF, where DS = design storm volume and MRF = mean rainfall depth per storm) and the 98th percentile storm for the recreation criteria (DS=3.91 x MRF). We feel that this design parameter will more likely meet the water quality cirteria set in Section 3.2.

3. The combined sewered overflow area for the Chicago urbanized area was changed for the final report to 243,700 acres as opposed to the 240,000 acres utilized draft report. This 243,700 acres includes the 375 square miles of combined sewered area in the district and additional areas outside the sanitary district boundaries.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions, and if I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ted Horn, USEPA Region V
Needs Survey Coordinatory

RECEIVED 12/6/76

METROPOLITAN SEWERAGE DISTRICT
OF THE COUNTY OF MILWAUKEE
P.O. BOX 2079 MILWAUKEE, WISCONSIN 53201
PHONE 271-2403

Sewerage Commission of the City of Milwaukee · Metropolitan Sewerage Commission of the County of Milwaukee

December 1, 1976

Mr. Harold P. Cahill, Director
Municipal Construction Division
WH-547
U.S. Environmental Protection Agency
401 M Street, S. W.
Washington, D. C. 20460

Dear Hal:

I have reviewed the draft of the 1976 survey of needs for CSO and feel that more work needs to be done to refine this information.

For example, in the ongoing CSO study now being conducted by the Milwaukee Sewerage Commission, we are beginning to distill concepts to a point where we can estimate more closely what needs to be done and the associated capital investment. One of the points that has been established is that along with dealing with the overflows themselves, it will be necessary to consider a program of dredging the Milwaukee River. There is an accumulation of organic solids deposited at the bottom of the Milwaukee River. To achieve the dissolved oxygen level of 5 mg/l will not only require the removal of untreated overflows, but also will require the removal of the deposited solids in the bottom of the river. This combination should restore the Milwaukee River to meet the water quality requirements imposed by the State of Wisconsin. Further, a technology needs to be developed on optimizing the collection and treatment systems as a community or District package. It is not enough to optimize the individual treatment plants in a district, or to optimize independently the solids handling and disposal strategies, or to optimize independently a system of handling combined sewer overflows. All of the decision making in these three major areas needs to be done with regard to an overall system basis to minimize undesirable impacts on the water quality, and to minimize the undesirable impacts on the environment by the disposal of the waste sludges.

I am looking forward to seeing you at the meeting in January.

Best regards,

Bill

William J. Katz
Director of Planning, Development
& Consultant Coordination

WJK:sl

1974 Amer. Soc. of Civil Engrs. Landmark Award • 1974 Amer. Soc. of Civil Engrs. Wisconsin Engr. Achievement

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. William J. Katz
Director of Planning, Development and
Consultant Coordination
Metropolitan Sewerage District of the County
of Milwaukee
Post Office 2079
Milwaukee, Wisconsin 53201

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Katz:

Thank you for your letter of December 1, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

The methodology utilized in the 1976 Needs Survey for Category V was not intended to provide detailed cost estimates for control costs on a facility-by-facility basis. The methodology does, however, provide a consistent basis for comparison of the needs among the states.

Your specific problem of organic solids deposition in the Milwaukee River should be analyzed to evaluate the most cost-effective method of meeting the required stream criteria. The time and budget constraints precluded this type of analysis on all urbanized areas in the country. Ongoing 201 and 208 studies should provide a more detailed data base in the future.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions, and if I can be of any further assistance, please let me know.

Sincerely yours,

J. A. Chamble

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ted Horn, USEPA Region V
Needs Survey Coordinator

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SANITARY ENGINEERING
770 GOLDEN GATE AVE. 3RD FL. SAN FRANCISCO, CAL. 94102 (415)558-2131

November 19, 1976

1976 EPH
Needs Survey:
Cat.'s V and VI

State Water Resources Control Board
P. O. Box 100
Sacramento, CA

Attention: Mr. Ed Dito

Gentlemen:

This letter is in response to the request of Mr. Dito of your staff and members of the EPA staff on the subject project to Mr. Cockburn of my staff for comments on the draft 1976 needs survey report for combined sewer overflow control and stormwater control (Categories V and VI respectively).

As Mr. Cockburn stated at the presentation meeting on November 8, 1976 in the EPA offices, we are greatly dismayed at the lack of coordination exhibited by the EPA in producing such a report without any contact with local or State agencies who have been intimately involved in the problem. Further, if it had not been for Mr. Dito's invitation, we would not have had any opportunity to comment on this report which might have severe impact upon the City's present program (as well as the State's). The time allowed to review and comment on the report was also much too short for any detailed review.

I am attaching a list of the City's general comments with specific examples where we have had time to develop them. Basically, the report estimates costs about ten times lower than our estimates for the same facilities. Also the basic methodology and control levels selected are subject to severe question. There appears to be little in the report to recommend it without major revision.

In light of the short time for review and the possible importance of such report in terms of funding, it is our request that the adoption and publication of this survey be delayed pending detailed review and revision.

We will be available to answer any questions which you might have concerning our comments and further to also aid and support your staff in conveying our comments to the EPA.

Very truly yours,

A. O. Friedland, Chief
Bureau of Sanitary Engineering

Attach: As Noted

cc: EPA
Region IX Attn: Mr. Robert Rock

EPA
Municipal Construction Division
401 M St. S.W. WH 547
Washington D.C. 20460 Attn: Mr. Wen H. Huang

State of Ore.
Dept. of Environmental Quality
1234 S.W. Morrison St.
Portland, Oregon 97205 Attn: Mr. C. P. Hilbrick, Jr.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

11 JAN 1977

Mr. A.O. Friedland, Chief
Bureau of Sanitary Engineering
Department of Public Works
City and County of San Francisco
770 Golden Gate Avenue, 3rd Floor
San Francisco, California 94102

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Friedland:

Thank you for your letter of November 19, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

After reviewing comments on the draft report, several changes have been made which significantly affect the needs estimates for Categories V and VI. The final needs estimate for the State of California is $385.115 million dollars, as compared with the draft report figure of $159 million.

In regard to your specific comments, the decision to apply a uniform set of wet weather standards and a uniform methodology to estimate state-by-state needs was developed based on the fact that nationwide information on a facility-by-facility basis is not available for either the combined sewer overflow problem or the stormwater problem.

The method for developing storage volumes and treatment rates was developed from existing literature and several simplifying assumptions. The methodology was evaluated in detail in several cities and showed that the 80th percentile storm event would result in between 10 and 20 overflows per year and capture approximately 80 percent of the rainfall runoff. In the final report the control levels for combined sewer will be increased in response to comments which were received. The cost of achieving the aesthetics and the fish and wildlife criteria will be evaluated for control of the 90th percentile storm period. The cost of achieving the recreation criteria will be evaluated for an 98th percentile storm. For Category VI, all criteria will be evaluated for an 80th percentile storm. The final report will contain an expanded discussion of toxic pollutants.

Section 8.4 and 9.2 of the draft report discussed the differences in cost estimates between the 1973, 1974 and 1976 estimates. This section will be expanded to include comparison of the NCWQ cost estimates for the final report.

After a review of the cost equations in the draft report, several equations for unit processes were modified to represent more accurately the cost of actual construction. Significant adjustments were made to the pumping equation and to the storage equation. These changes, in addition to increasing the size of the design storm, provided the major reasons for the approximate doubling of the Category V cost estimate that was mentioned earlier.

Our Sanitary Engineer, Wen Huang, called Mr. R.T. Cockburn and requested the bid tabulations for the pumping station in question. As soon as we receive the material from you and complete the analysis, we will write to you further on this subject.

The final report, including all comments received, will be forwarded to you in early February 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Mr. John E. Bryson, Chairman
State Water Resources Control Board
Post Office Box 100
Sacramento, California 95801

Robert Rock, USEPA Region IX
Needs Survey Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] JAN 1977

Mr. Robert T. Cockburn
Sanitary Engineer
Bureau of Sanitary Engineering
Department of Public Works
City and County of San Francisco
770 Golden Gate Ave.
3rd Floor
San Francisco, California 94102

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Cockburn:

Thank you for your letter of January 7, 1977, providing us with three sets of cost data in San Francisco related to combined sewer overflows and stormwater control (Categories V & VI).

We have thoroughly gone over these cost data but were unable to breakdown the cost items detailed enough to provide us with meaningful analysis.

We would appreciate your further providing us of the cost breakdown of the following items which were indicated in your cost data:

1. Preliminary and Primary Treatment, (i.e. the items included in the Pretreatment Building).
2. All work to be done under Specification No. 22568: but excluding the work set forth under bid items 2, 3, 4 and 5.

It will be helpful if you provide us with engineering data along with cost data.

We very much appreciate your interest and assistance.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Rock, US EPA Region IX
Needs Survey Coordinator

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COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES

POST OFFICE BOX 2357
HARRISBURG, PENNSYLVANIA 17120

December 1, 1976

James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M Street, S. W.
Washington, D. C. 20460

Dear Mr. Chamblee:

In response to Mr. Cahill's letter of October 22, 1976 concerning the draft report of Needs for Combined Sewer Overflows and Storm Water Discharges, I am transmitting the following comments on behalf of the Region III group of states, which met on November 30, 1976:

(1) While we are unable to comment in detail on the techniques used to compute the needs, we noted with approval that the procedure avoids the use of a "broad-brush" rigid technology requirement for estimation of treatment levels.

(2) We note that the assimilation capacity of the receiving water is used. We agree with this concept.

(3) We wish to raise a question as to whether the application of this concept would require a legislative amendment or some administrative adjustment in view of the "secondary" treatment requirement.

Sincerely yours,

Wesley E. Gilbertson

WESLEY E. GILBERTSON
Special Assistant for Planning

WEG/ch
cc: Region III Group
Committee of Ten

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible] JAN 1977

Mr. Wesley E. Gilbertson
Special Assistant for Planning
Pennsylvania Department of Environmental Resources
Post Office Box 2357
Harrisburg, Pennsylvania 17120

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Gilbertson:

Thank you for your letter of December 1, 1976, offering the comments of the Region III group of states on our draft report which estimated needs for combined sewered overflows and stormwater control (Categories V & VI).

We appreciate your comment on the use of the assimilative capacity of the receiving water. It is our interpretation that the secondary treatment requirement applies to dry weather pollution control works and does not apply to combined sewer overflows. In this latter case both a cost-effectiveness and a cost-benefit analysis is required to determine the amount and degree of treatment of wet weather flows which are eligible for Federal grant funding (see PGM 61/PRM 75-34, "Grants for Treatment and Control of Combined Sewer Overflows and Stormwater Discharges").

The final report, including all comments received from the state, will be forwarded to you in early February 1977.

If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, USEPA Region III
Needs Survey Coordinator

DELAWARE RIVER BASIN COMMISSION
P. O. BOX 7360
WEST TRENTON, NEW JERSEY 08628
(609) 883-9500

OCTOBER 27, 1961

JAMES F. WRIGHT
EXECUTIVE DIRECTOR

HEADQUARTERS LOCATION
25 STATE POLICE DRIVE
WEST TRENTON, N. J.

December 1, 1976

Mr. James Chamblee
Chief, Needs Assessment Section
Facility Requirements Branch (WH-547)
401 M. Street S.W.
Washington, D.C. 20460

Dear Mr. Chamblee:

This is in response to your October 22, 1976 request for comments on your 1976 Needs Survey Category V, combined sewer overflows, and category VI, storm sewers. We are interested in this report since the Delaware River at Philadelphia was used as an illustration. The Commission, as part of a program being carried out under Section 208 of PL 92-500, along with EPA Region III, Delaware Valley Regional Planning Commission, and the States of New Jersey, Pennsylvania and Delaware are involved in a storm water survey for the Delaware Estuary to assess the effects of non-point pollutants.

In addition, under EPA Grant #P003106-01-0 and Section 208 of PL 92-500 we are developing a two dimensional link-node mathematical model of the Delaware Estuary which will be used for establishing waste discharge allocations for point source and gross allotments for non-point sources. The model will evaluate loads for current standards and also be used to consider the practicality or revision in standards. This program is scheduled for completion in 1977.

We are including a copy of our Water Quality Standards for the Delaware River Basin and a copy of the allocated discharges and their River Mileages. These may help your evaluation of costs or at least complete your data base.

Thank you for the opportunity to comment on this report.

Sincerely,

Seymour D. Selzer

Seymour D. Selzer
Head, Planning Branch

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. Seymour D. Selzer
Head, Planning Branch
Delaware River Basin Commission
Post Office Box 7360
West Trenton, New Jersey 08628

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Selzer:

Thank you for your letter of December 1, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

We also appreciate receiving a copy of the water quality standards and allocated discharges for the Delaware River Basin. This information will be of help in refining the water quality criteria to be used in the final report. We are also pleased to hear of detailed studies being conducted on the Delaware River Basin in relation to the Section 208 planning studies. The mathematical modeling of the Delaware Estuary and resulting waste discharge allocations for all waste sources will provide a much more specific data base for future needs estimates.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

If I can be of further assistance, please let me know.

Sincerely,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, Region III

INTERSTATE SANITATION COMMISSION

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DIRECTOR-CHIEF ENGINEER

December 1, 1976

Mr. James Chamblee, Chief
Needs Assessment Section
Facility Requirements Branch (WH-547)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D. C. 20460

Dear Mr. Chamblee:

At the request of Mr. Cahill, we have reviewed and herewith offer comments on the draft report "1976 Survey of Needs for Control of Pollution from Combined Sewer Overflows and Stormwater Discharges" prepared for the U.S. EPA.

(1) Within the New York-New Jersey Metropolitan Area, most of the sewers are combined and many are very large in diameter. These large diameter sewers act as settling basins in many cases during dry weather flow. When it rains, therefore, the combined sewers not only overflow the sewage flowing during the rainfall but also much of the solids and contaminants absorbed on the solids that occurred during the dry weather. In reviewing the draft report, we are unable to see that this point has been realized and it is an important one since in this region possibly as much as 50% or more of the solids in the sewers never reach the treatment plants and thus the combined sewer overflow loadings on the receiving waters caused by rainfall are considerable.

.../...

(2) With the foregoing in mind, it makes little sense to commit the limited resources available to achieve wastewater treatment levels greater than secondary treatment until the combined sewer overflow problem can be meaningfully addressed.

We hope these comments prove useful. If we may be of further assistance, please do not hesitate to contact us.

Very truly yours,

Tom Glen

Thomas R. Glenn
Director & Chief Engineer

TRG:rym

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

Mr. Thomas R. Glenn
Director & Chief Engineer
Interstate Sanitation Commission
10 Columbus Circle
New York, New York 10019

RE: Draft Report for 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Glenn:

Thank you for your letter of December 1, 1976, offering comments on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

We agree that the accumulation of solids in large combined sewers during dry weather periods is a significant portion of the combined sewer problem. This was considered in the developemnt of the draft report and all facilities were sized such that the "first flush" or heavily contaminated portion of run-off in the earlier stages of the storm event would be captured and treated to the degree required by the receiving water analysis. Only after capture and treatment of the design storm would any overflows of combined sewage reach the receiving water.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of any further assistance, please let me know.

Sincerely yours,

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Robert Olson, USEPA Region II
Needs Survey Coordinator

RECEIVED
12/10/76

SUSQUEHANNA RIVER BASIN COMMISSION
5012 Lenker Street • Mechanicsburg, Pennsylvania 17055

From the Office of the
Executive Director

December 8, 1976

Mr. Harold P. Cahill, Director
Municipal Construction Division
(WH-547)
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Mr. Cahill:

This is in reply to your letter of October 27, 1976 requesting review and comment on the draft report, "1976 Survey of Needs For Control of Pollution From Combined Sewer Overflows and Stormwater Discharges." We have reviewed the report and believe, that as a national assessment, it provides a good cost estimate for removing oxygen demanding materials from combined sewer overflows.

Of major significance; however, is the need for control of toxic contaminants associated with urban runoff. Although it was recognized in the subject draft report, costs for the removal of toxic materials are not included in the assessment. I believe this should be addressed in the future needs survey.

Sincerely yours,

Robert J. Bielo
Executive Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

6 JAN 1977

Mr. Robert J. Bielo,
Executive Director
Susquehanna River Basin Commission
5012 Lenker Street
Mechanicsburg, Pennsylvania 17055

RE: Draft Report on 1976 Needs
Survey for Combined Sewer
Overflows and Stormwater

Dear Mr. Bielo:

Thank you for your letter of December 8, 1976, commenting on our draft report which estimated needs for combined sewer overflows and stormwater control (Categories V & VI).

Your comment on the need for control of toxic contaminants is appreciated and understood. However, there was no nationwide data base on the generation rates of these pollutants from stormwater runoff, the removal efficiences by the unit processes for these toxic materials, or the potential cost-effectiveness of source controls. Therefore, the control of toxic pollutants could not be analyzed in the current needs survey. Completion of on-going 208 studies and other stormwater studies will provide a much more specific data base for use in the future needs surveys.

The final report, including all comments received from the states, will be forwarded to you in early February, 1977.

I hope that this has answered your questions. If I can be of further assistance, please let me know.

Sincerely yours,

J. A. Chamblee

James A. Chamblee, Chief
Needs Assessment Section
(WH-547)

cc: Ken Pantuck, Region III
Robert Olson, Region II

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